THE ATHENÆUM

Journal of English and Foreign Literature, Science, and the Fine Arts.

No. 674. LONDON, SATURDAY, SEPTEMBER 26, 1840. PRICE FOURPENCE. (Stamped Edition, 5d.)

For the convenience of Subscribers in remote places, the weekly numbers are reissued in Monthly Parts, stitched in a wrapper, and forwarded with the Magazines.—Subscriptions for the Stamped Edition for the Continent, for not less than 3 Months, and in advance, are received by M. BAUDRY, 9, Rue du Coq-St.-Honoré, Paris, or at the Athenæum Office, London. For France, and other Countries not requiring postage to be paid in London, 28 fr. or 1l. 2s. the year. To other countries, the postage in addition. [JAMES HOLMES, TOOK'S COURT.]

UNIVERSITY COLLEGE, LONDON.—FACULTY OF MEDICINE.—Session 1840-41.
The Classes will commence as follows:
ANATOMY and PHYSIOLOGY..Professor Sharpey, M.D. October 1, at 10 o'clock.
CHEMISTRY..Professor Graham. October 1, at 11 o'clock.
ANATOMY..Professor Quain. October 1, at 12 o'clock.
MEDICINE..Professor Williams, M.D. October 1, at 6 o'clock.
SURGERY..Professor Cooper. October 1, at 7 o'clock.
COMPARATIVE ANATOMY..Prof. Grant, M.D. October 2, at 3 o'clock.
MIDWIFERY..Professor Davis, M.D. October 5, at 9 o'clock.
MATERIA MEDICA..Prof. Thomson, M.D. October 5, at 3 o'clock.
Prospectuses and further particulars may be obtained at the Office of the College.
S. COOPER, Dean of the Faculty.
CHAS. C. ATKINSON, Secretary to the Council.
18th Sept. 1840.

UNIVERSITY COLLEGE, LONDON.—FACULTY OF ARTS AND LAWS.—Session 1840-41.
The Session will commence on Wednesday, the 14th October, when Professor Creasy will deliver a Lecture INTRODUCTORY to his own Courses, at Two o'clock precisely.
Classes.
LATIN..Professor Key, A.M.
GREEK..Professor Malden, A.M.
HEBREW..Professor Hurwitz.
ARABIC, PERSIAN, and HINDUSTANI..Prof. Falconer, A.M.
CHINESE LANGUAGE and LITERATURE..Professor Rev. Samuel Kidd.
ENGLISH LANGUAGE and LITERATURE..Prof. Latham, A.M.
FRENCH LANGUAGE and LITERATURE..Prof. Merlet.
ITALIAN LANGUAGE and LITERATURE..Prof. Pepoli.
GERMAN LANGUAGE..Teacher, Mr. Wittich.
MATHEMATICS..Professor De Morgan.
NATURAL PHILOSOPHY..Professor Sylvester, F.R.S.
CHEMISTRY (Practical Course, commencing in May)..Professor Graham, F.R.S.
CHEMISTRY (Course for the Matriculation Examination in Arts at the University of London)..Professor Graham.
BOTANY, Junior Class do. (commencing in April)..Professor Lindley, Ph. D.
ZOOLOGY..Professor Grant, M.D.
PHILOSOPHY OF MIND and LOGIC..Professor the Rev. J. Hoppus, Ph. D.
HISTORY, ANCIENT and MODERN..Professor Creasy, A.M.
ENGLISH LAW (commencing 4th Nov.)..Prof. Carey, A.M.
JURISPRUDENCE (commencing 3rd Nov.)..Prof. Graves, A.M.
CIVIL ENGINEERING..Professors De Morgan, Graham, and Sylvester.
DRAWING, in all its branches..Teacher, Mr. G. B. Moore.
SCHOOLMASTERS' COURSES..Professors Key, De Morgan, Sylvester, and Malden.
FLAHERTY SCHOLARSHIPS.
A Flaherty Scholarship of 50l. per annum, tenable for four years, will be awarded in 1841 to the best proficient in Classics among the Students of the College under the age of twenty years. The Examination will take place in the second week in October. A similar Scholarship for proficiency in Mathematics and Natural Philosophy will be awarded in 1842, and in subsequent years, alternately, for proficiency in Classics, and in Mathematics and Natural Philosophy. Printed copies of the Regulations concerning these Scholarships may be had on application at the Office.
The Session of the Faculty of Medicine commences on 1st October.
14th August, 1840.
T. HEWITT KEY, Dean of the Faculty.
CHAS. C. ATKINSON, Secretary to the Council.

KING'S COLLEGE, LONDON.—DEPARTMENT of CIVIL ENGINEERING and ARCHITECTURE, and of SCIENCE applied to the Arts and Manufactures.—This Department, under the superintendence of Professors Hall, Moseley, Daniell, Wheatstone, Hosking, and Ansted, and Mr. Bradley, Mr. E. Cowper, Mr. J. Tennant, and Mr. H. J. Castle, will be RE-OPENED on TUESDAY, the 6th October next.
A Junior Class, for Pupils of the age of 14 years or upwards, will also be opened on the same day.
Sept. 1840. J. LONSDALE, Principal.

KING'S COLLEGE, LONDON.—DEPARTMENT of GENERAL LITERATURE and SCIENCE.—The COURSES will RE-COMMENCE on Tuesday, the 6th October next.
DIVINITY..The Rev. the Principal.
CLASSICAL LITERATURE..The Rev. R. W. Browne, M.A.
MATHEMATICS..The Rev. T. G. Hall, M.A.
ENGLISH LITERATURE..The Rev. F. Maurice, M.A.
NATURAL PHILOSOPHY and ASTRONOMY..The Rev. H. Moseley, M.A.
EXPERIMENTAL PHILOSOPHY..Charles Wheatstone, Esq. F.R.S.
ARTS of CONSTRUCTION..W. Hosking, Esq. F.S.A.
THEORY of the FINE ARTS..W. Dyce, Esq. M.A.
POLITICAL ECONOMY..The Rev. Richard Jones, M.A.
LAW..E. Bullock, Esq. M.A.
GEOLOGY..D. T. Ansted, Esq. M.A. F.G.S.
ZOOLOGY..Thomas Bell, Esq. F.R.S.
CHEMISTRY..J. F. Daniell, Esq. F.R.S.
BOTANY..David Don, Esq. Lib. L.S.
MINERALOGY..Mr. J. Tennant, F.G.S.
MACHINERY..Edward Cowper, Esq.
GEOMETRICAL DRAWING..T. Bradley, Esq.
SURVEYING..H. I. Castle, Esq.
HEBREW and RABBINICAL LITERATURE..The Rev. M. S. Alexander.
ORIENTAL LANGUAGES..Duncan Forbes, Esq.
FRENCH LANGUAGE and LITERATURE..Isidore Brasseur, Esq.
GERMAN Ditto..Adolph Bernays, Philos. D.
ITALIAN Ditto..G. Rosetti, Esq. L.L.D.
SPANISH Ditto..
SCHOOL.
The Classes will be re-opened on Thursday, the 1st October.
September, 1840. J. LONSDALE, Principal.
N.B. Chambers are provided for such Students in the Senior or Medical Department as are desirous of residing in the College; and some of the Professors, and other Gentlemen connected with the College, receive Students into their houses.

TO PARENTS and GUARDIANS.—A LADY, who resides in a pleasant and healthy spot in the immediate vicinity of the West End of London, WOULD LIKE TO RECEIVE A LITTLE GIRL as one of the family, to educate with her own children. Age not to exceed nine or ten years. Parents who are about to leave England for India or the Colonies, and desirous of insuring to their offspring a virtuous domestic education, in which the tenderness of the mother is blended with the vigilance of the instructor, would find this an opportunity that rarely offers. Terms, including everything, 100l. per annum.—Address to B. M., Post-office, Kilburn, Middlesex.

COMMERCIAL SCHOOL, GOTHIC HALL, ENFIELD, MIDDLESEX, by T. WEARE.—The intellectual improvement, moral character, and domestic comfort of the Pupils, are the objects of unremitting attention. Terms, from 25 to 35 Guineas per annum, according to the studies pursued. Washing 2½ Guineas. Referees:—Rev. J. J. Davies, Tottenham; D. M'Niel, Esq. Stock Exchange; Y. Ford, Esq. Clapham-road; and Mr. Davies, Surgeon, 128, Holborn-hill. No day scholars are admitted. Accommodation for Parlour Boarders.

PECKHAM SCHOOL, established upwards of 80 years, combines advantages not to be surpassed: the spacious mansion, gardens, play-ground, gymnasia, bath, &c., afford every facility for healthful accommodation and exercise; whilst the vicinity of Sydenham, Forest Hill, and other delightful and salubrious southern borderings of the Metropolis, invite to more extensive recreations. The domestic comforts have ever met with approval; and the distinction that has attended the gentlemen educated at this School, is a sure guarantee for success in the prosecution of studies for academical, professional, or mercantile pursuits. French is constantly spoken, and the Pupils have access to a carefully-selected library.—Prospectuses at Messrs. Bowdery & Kerby's, 190, Oxford-street; and Messrs. Relfe & Fletcher's, 17, Cornhill; or address to the Principal, Peckham School, Surrey.

QUEEN'S COLLEGE, EDINBURGH, WINTER SESSION, 1840-41.
The following CLASSES will be OPENED on WEDNESDAY, 4th NOVEMBER:

Pathology and Practice of Physic	Dr. W. Henderson	9 A.M.
Chemistry	Dr. Wilson	10 A.M.
Practical Chemistry	Dr. Wilson	9 to 4.
Physiology	Dr. John Reid	10 A.M.
Anatomy (Elementary and Descriptive)	Dr. Knox	11 A.M.
Anatomy (Demonstrations, including Surgical Anatomy)	Dr. Knox	3 P.M.
Practical Anatomy	Under the superintendence of Dr. Knox and Dr. Lonsdale	9 A.M. to 4 P.M.
Natural Philosophy	George Lees, A.M.	12 noon.
Practical Mechanics	Mr. Lees	1 to 4.
Forensic Medicine (Mondays, Wednesdays, and Fridays)	Mr. Skae	1 P.M.
Surgery	Dr. J. Argyll Robertson	2 P.M.
Midwifery	Dr. Campbell	3 and 6 P.M.
	Dr. Marr	3 and 6 P.M.
Materia Medica	Dr. W. Seller	7 P.M.
Mineralogy and Geology (with Excursions)	Mr. A. Rose	3 P.M.
Botany	W. Macgillivray, A.M.	—
Mathematics	W. Nichol, A.M.	10 to 2.
	W. Galbraith, A.M.	9 to 2.
	Mr. Murray	12 to 4.
Veterinary Surgery	Mr. Dick, Professor to the Highland Society	7 P.M.

ROYAL INFIRMARY, at Noon *Daily.*

Clinical Medicine.		
Clinical Surgery (Tuesdays and Thursdays)	Dr. J. Argyll Robertson	1 P.M.

LANGUAGES.

Greek Language and Literature (Ancient and Modern)	Mr. Negris	Junior	9 A.M.
		Senior	10 A.M.
		Superior	2 P.M.
Scriptures and Greek Fathers (on Saturdays)	Mr. Negris	Junior	10 A.M.
		Senior	11 A.M.
Arabic and Persian, Hindustani, &c.	Mr. Ballantyne		1 P.M.
French (Mondays, Wednesdays, and Fridays)	Mr. Chaumont		7 P.M.
German (Do. Do.)	Mr. Kombst		8 P.M.
Italian (Tuesdays and Thursdays)	Mr. Rampini		8 P.M.

COURSES of LECTURES on the LANGUAGES and LITERATURE of FRANCE, GERMANY, and ITALY, &c., will be delivered towards the close of the Session.
A Reading-Room, containing the principal British and Foreign Medical and Scientific Journals, will be open for the use of the Students at the beginning of the Session.
FEES.
Fees to each of the above Courses:—First Course, 3l. 5s.; Second Do. 2l. 4s.; Perpetual, 5l. 5s., with the following exceptions:—Greek,—3l. 3s. each Course; Scriptures, 1l. 11s. 6d.; Both, 4l. 4s. Anatomy,—First Course, 3l. 5s.; Second Do. 3l. 3s.; Perpetual, 6l. 6s.
Practical Anatomy,—1l. 1s. each Course of Three Months.
Natural Philosophy,—Six Months' Course, 3l. 3s.
Practical Mechanics,—First Course of Three Months, to those attending the Lectures, 2l. 2s.; Second, 1l. 1s.; to those not attending the Lectures, 3l. 3s. and 2l. 2s.
Forensic Medicine, Mineralogy and Geology, and Modern Languages, 2l. 2s. each.
Prizes and Honorary Certificates will be given by each Lecturer, and by the College, to the most distinguished Students.
Attendance at Medical Classes in Queen's College qualifies for Graduation at the University of London, and at the Universities of Oxford, Cambridge, St. Andrews, and Aberdeen; and for Examination at the Royal Colleges of Surgeons of London, Edinburgh, and Dublin; the Apothecaries' Hall; the Faculty of Physicians and Surgeons of Glasgow; and the Army and Navy, and other Public Boards.
Licentiates of the Veterinary School are eligible for appointments in the Army, and East India Company's Service.
SUMMER SESSION.
The following Subjects will be taught:—NATURAL PHILOSOPHY, PRACTICAL MECHANICS, CHEMISTRY, PRACTICAL CHEMISTRY, PRACTICAL ANATOMY and OPERATIVE SURGERY, MIDWIFERY, BOTANY, FORENSIC MEDICINE, and the MODERN LANGUAGES.
17, Dublin-street, 19th Sept. 1840. JOHN ROBERTSON, Solicitor, Secretary to the College.

MANCHESTER NEW COLLEGE, IN CONNEXION WITH THE UNIVERSITY OF LONDON.
Sir BENJAMIN HEYWOOD, Bart. President.
The COLLEGE will OPEN for the ADMISSION of STUDENTS on the 5th OCTOBER next, in Grosvenor-square, Chorlton-upon-Medlock. The Committee solicit the attention of the public to the Course of Instruction provided in the *Literary and Scientific Department*, viz.:—
I. Greek and Latin Languages; Lectures on the Grammatical Structure of the English Language, with Exercises in English Composition, F. W. NEWMAN, Esq. B.A., late Fellow of Balliol College, Oxford, and Classical Tutor in Bristol College.
II. Pure and Mixed Mathematics, R. FINLAY, Esq. B.A., Trinity College, Dublin.
III. Ancient and Modern History, and the History of Literature, Rev. JOHN KENRICK, M.A.
IV. Mental and Moral Philosophy, and Political Economy, Rev. J. MARTINEAU, of Liverpool.
V. Physical Science and Natural History, MONTAGUE L. PHILLIPS, Esq.
The entire Course will comprise three Sessions of nine months each, extending from the beginning of October to the end of June. The Classes of the first year will be occupied in preparing for Matriculation at the University of London; those of the second and third years, in preparing for the Degree of Bachelor of Arts. Students will be admissible into the College on the completion of their fifteenth year. Those who enter with a view to graduation will be required to undergo an examination in Classics and Mathematics previous to admission, and to submit to the prescribed exercises and examinations during the whole course; but the Classes will be open to other students, with whom submission to such exercises and examinations will be optional.—A detailed statement of the course of study, with a list of fees, is published, and may be obtained at the principal Booksellers in Manchester and Liverpool; or on application personally to the following Members of the Committee:—
Samuel Robinson, Esq. Dukinfield.
J. Aspinal Turner, Esq. Cross-street, Manchester.
Robert Worthington, Esq. No. 8, Princess-street, Manchester.
James Heywood, Esq. Acresfield, near Manchester.
Rev. W. Gaskell, Dover-street, Chorlton-upon-Medlock.
Samuel D. Darbishire, Esq. Marsden-street, Manchester.
Or by letter to the Secretaries, to the care of S. D. Darbishire, Esq.
Manchester, Sept. 15, 1840.

MIDDLESEX HOSPITAL SCHOOL of MEDICINE.—The WINTER SESSION will commence on THURSDAY, October 1, 1840.
ANATOMY, PHYSIOLOGY, DEMONSTRATIONS, and DISSECTIONS, by E. W. Tuson, F.R.S., Mr. Erasmus Wilson, and Mr. Lonsdale.
MEDICINE, by J. Copland, M.D. F.R.S., and F. Leighton, M.D.
SURGERY, by H. Mayo, F.R.S.
MIDWIFERY, by J. North, F.L.S.
MATERIA MEDICA, by Mervyn Crawford, M.D.
CHEMISTRY, by Mr. Everitt.
FORENSIC MEDICINE, by Mr. C. De Morgan.
BOTANY, by Mr. Meade.
CLINICAL MEDICINE, by Dr. Hawkins, Dr. Watson, and Dr. Wilson.
CLINICAL SURGERY, by Mr. Mayo, Mr. Arnott, and Mr. Tuson.
Perpetual Fee to the whole of the Lectures 45l.
The INTRODUCTORY ADDRESS on the opening of the Session will be delivered by Herbert Mayo, F.R.S. on Thursday, October 1st, at Two o'clock.
A Public Distribution of Prizes will take place at the termination of the Winter Session.
The Museum, Library, and Reading-room, are open for the use of the Pupils.
For further particulars apply to the Secretary of the Hospital.

BOARD and RESIDENCE for YOUNG LADIES in a delightful and healthy part of Camberwell.—A Lady and her Sisters, who have had the advantage of a superior education, and move in genteel society, would be happy to receive TWO or THREE YOUNG LADIES, who would like to join a cheerful family circle, chiefly devoted to Music and Literary pursuits. For Terms, and other particulars, apply to Mrs. Dean, 10, Red Lion-square; if by letter post free.

TO MR. VAN VOORST, Paternoster-row, Publisher of 'The Illustrations of Shakspeare's Seven Ages.'
Sir,—Having been informed that we have done wrong in publishing from the above work a Card with the following Illustrations:—
Sir David Wilkie's .... 'Infant.'
Mr. Collins's .... 'Schoolboy.'
Mr. A. E. Chalon's .... 'Lover.'
Mr. Abm. Cooper's .... 'Soldier.'
Sir Augustus Callcott's .... 'Justice.'
Mr. Edwin Landseer's .... 'Pantaloon.'
Mr. Hilton's .... 'Last scene of all.'
We hereby agree, in consideration of your consenting to stay proceedings at law against us for such infringement of your copyright, to give up the plate and all the impressions now in our possession, and to pay your solicitor's charges.
JOHN SMITH,
JAMES SMITH,
10, King-street, Snow-hill.
Sept. 8th, 1840.
Witness, RICHD. COMINS, 7, Warwick-court, Gray's Inn, Solicitor for Mr. Van Voorst.

Next Wednesday, with the Magazines, will be ready, in 3 vols. with Illustrations by Hervieu,
LADY BULWER'S BUDGET OF THE BUBBLE FAMILY; A NOVEL.
"Bubble, bubble, toil and trouble."—*All the Witches.*
*** All orders for this work should be given at the Libraries and Booksellers' throughout the United Kingdom, in order to obtain it punctually on the day of publication.
Edward Bull, Publisher and Librarian, 19, Holles-street, Cavendish-square.

MONTHLY CATALOGUES OF OLD BOOKS.
Now ready,
THE SHEET CATALOGUE for the Present Month, containing many valuable and curious Articles now offered for Sale by JOHN BRYANT, the Camden Head, 9, King William-street, West Strand, London.
Parties desirous of having the Catalogues forwarded on the day of publication, are requested to hand their addresses, when they will be sent *postage free.*

737

YORK and LONDON ASSURANCE COMPANY.
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The terms both for Fire and Life Assurance will be found to combine all the advantages offered by other Companies. Prospectuses may be had at the Offices, King William-street, London, and High Ousegate, York; or of any of the Agents.
J. REDDISH, Sec.

UNITED KINGDOM LIFE ASSURANCE COMPANY, 8, Waterloo-place, Pall Mall, London.
The first Septennial Division of Profits of this Company will be declared in the ensuing year on all Policies of the participating class effected previous to the 31st December, 1840. Parties, therefore, who wish to Insure their Lives, should avail themselves of the opportunity they now have of sharing in the bonus so soon to be declared by immediately making proposals.
The following are the Annual Premiums for the assurance of 100*l.* for the whole period of life, on which half credit may be allowed for five years; which credit may remain at five per cent. interest, to be deducted at death from the sum insured:—

Age.	Without Profits.	With Profits.
20	£1 13 10	£1 18 8 per Cent.
30	2 3 10	2 8 2
40	2 19 1	3 3 4
50	4 6 0	4 10 7

Annual Premium for assuring 100*l.* payable at a fixed age, or at death, should it occur before the party attains that age:—

Age when assured, / Age to be attained.	Sixty.	Sixty-five.	Seventy.
20	£2 6 1	£2 2 4	£2 0 0
30	3 2 10	2 15 2	2 10 6
40	4 19 0	4 0 3	3 9 7
50	10 14 10	7 8 1	5 12 2

EXAMPLE.—A person aged 20, by paying an annual premium of 2*l.*, becomes entitled to 100*l.* on his attaining the age of 70, or to the same sum should he die before arriving at that age.
For the convenience of parties residing in the City, they may make their appearance and pass the medical examination before the Agents, Edward Frederick Leeks, Esq., 4, Scots-yard, Bush-lane, Cannon-street, and S. F. Youde, Esq. Surgeon, 9, Old Jewry.
Every information will be afforded on application to the Resident Director, Edward Boyd, Esq., No. 8, Waterloo-place. Proposals may be accepted on Wednesday at 3 o'clock, and any other day appearance may be made at half-past 2 o'clock, when Frederick Hale Thomson, Esq., the Company's Surgeon, is in attendance.
EDWARD LENNOX BOYD, Sec.

THE YORKSHIRE FIRE and LIFE INSURANCE COMPANY, established at YORK, 1824, empowered by Act of Parliament.—Capital, 500,000*l.*

Patrons—The Archp. of York	Sir G. Strickland, Bart. M.P.
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Actuary and Secretary—Mr. W. L. Newman.
The Terms of this Company for LIFE INSURANCES will be found on comparison to be the lowest which can be taken with safety, and particularly for FEMALE LIVES, the lowest charged by any Office in the Kingdom.—The following extracts from the Tables (complete Copies of which, with the Rates for the intermediate Ages, may be had on application at the Office in York, or any of the Agents,) will show the Annual Premiums required for securing 100*l.*, payable on the decease of

A MALE.

Age next Birthday.	Premiums for One Year.	Premiums for Seven Years.	Premiums for Whole Life.
20	£0 17 4	£0 18 4	£1 14 4
40	1 12 8	1 16 2	2 19 9
60	3 10 9	4 8 0	6 6 0
75	9 16 0	11 10 6	13 4 4
A FEMALE.			
20	£0 17 2	£0 18 4	£1 11 6
40	1 6 6	1 7 3	2 12 0
60	2 19 0	3 9 3	5 12 6
80	13 1 7	15 10 0	15 12 10

Table of Premiums payable for a *fixed number* of years *only.*

A MALE.

Age next Birthday.	Annual Premiums payable for 10 Years only.	Annual Premiums payable for 15 Years only.	Annual Premiums payable for 20 Years only.
20	£4 7 9	£3 4 3	£2 12 9
40	6 4 0	4 12 6	3 17 4
50	7 6 4	5 11 0	4 15 4
A FEMALE.			
20	£4 3 0	£3 1 0	£2 9 9
40	5 13 8	4 3 10	3 9 8
50	6 17 2	5 2 0	4 7 6

Table of Premiums payable on a Seven Years' *ascending Scale.*

A MALE.

Age next Birthday.	Annual Premiums payable first 7 Years.	Annual Premiums payable second 7 Years.	Annual Prems. payable for remainder of Life.
20	£1 4 0	£1 9 4	£2 3 0
40	2 8 9	3 1 3	3 8 8
50	3 2 6	3 19 0	5 12 0
A FEMALE.			
20	£1 4 0	£1 9 6	£1 16 8
40	1 16 10	2 7 0	3 8 2
50	2 11 3	3 4 6	5 9 0

Premiums payable on a Seven Years' *descending Scale.*

A MALE.

Age next Birthday.	Annual Premiums payable first 7 Years.	Annual Premiums payable second 7 Years.	Annual Prems. payable for remainder of Life.
20	£2 5 10	£1 14 6	£1 7 9
40	3 19 6	2 19 9	2 1 0
50	5 8 6	4 1 9	2 3 6
A FEMALE.			
20	£2 2 0	£1 11 6	£1 5 9
40	3 9 4	2 12 0	1 17 7
50	4 17 8	3 13 3	2 2 9

Insurances of the following description may also be effected at this Office, viz.: On the *First* Death of Two Lives; on the *Longest* of Two Lives; on the *First* Death of Three Lives; on the *Longest* of Three Lives; on the Decease of ONE LIFE before another. ANNUITIES AND REVERSIONS PURCHASED AND ANNUITIES GRANTED.
FIRE INSURANCES are effected by this Company at the most Moderate Rates for every description of Property. *FARMING STOCK* insured without the introduction of the *Average Clause.*
Agents are wanted in those Towns where no Appointments have been made; the Commissions allowed are such as to render the Agencies worthy the attention of respectable Parties. Applications to be made to
Mr. W. L. NEWMAN, Actuary and Secretary, York.

NATIONAL PROVIDENT INSTITUTION, for MUTUAL ASSURANCE of LIVES, ENDOWMENTS, and ANNUITIES, 13, Nicholas-lane, King William-street, London. *Directors.*

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Medical Directors.
J. T. Conquest, M.D. F.L.S. | Thomas Bevan, Esq. F.L.S.
Members whose premiums become due on 1st October next, are hereby informed that the same must be paid within thirty days from that time.
JOSEPH MARSH, Secretary.

SCOTTISH UNION FIRE and LIFE INSURANCE COMPANY, No. 449, West Strand, and No. 78, King William-street, Mansion House, London; George-street, Edinburgh; and Dame-street, Dublin.
Instituted 1824, and Incorporated by Royal Charter.

Directors—Charles Balfour, Esq.	Richard Oliverson, Esq.
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John Kingston, Esq.	

S. Mackenzie, Esq. Manager.
The distinguishing features of this Corporation are, UNQUESTIONABLE SECURITY, LOW RATES of PREMIUM, and a combination of all the important advantages hitherto offered to the Public both in the Fire and Life Department.
Every Policy issued by this Company renders it imperative on the Directors, in the event of dispute or difficulty arising, to refer the question to arbitration.
Claims for losses in London are settled at the Office, 449, West Strand.
FIRE DEPARTMENT.
Fire Insurances effected at the usual reduced rates; and Policies may be transferred to this Office without extra charge, and on terms very favourable to the Assured.
LIFE DEPARTMENT.
This Incorporation effects Life Insurances either at Reduced Rates without Profits, or with Participation in Profits, of which two-thirds are returned at regular periods, without being subject to any deduction for charges of management.
Tables of Rates and every information may be had at the Company's Offices; or of the Agents throughout the Kingdom.
No. 449, West Strand, and No. 78, King William-street, City.
F. G. SMITH, Secretary.

SCOTTISH UNION FIRE INSURANCE COMPANY.
EXTRACT from the Returns printed by order of the House of Commons, showing the amount of FIRE INSURANCE DUTY paid into the Exchequer for the year 1839, by the following Insurance Companies carrying on the business of Fire Insurance in LONDON. Also the Farming Stock (which is free of duty) insured in the same period by each Company respectively.

	Total duty paid, 1839.	Sum insured on Farming Stock, exempt.
Sun	£158,689 15 2	£6,747,495
Phœnix	130,151 0 1	4,742,405
Royal Exchange	68,876 17 9	4,643,560
Norwich Union	66,874 14 10	9,452,178
County	45,100 7 5	6,482,414
Guardian	34,918 7 9	562,295
Globe	33,322 3 4	1,052,852
West of England	32,424 10 0	898,369
Imperial	28,222 6 8	319,240
Alliance	25,513 8 11	539,817
Atlas	25,122 2 4	905,157
SCOTTISH UNION*	20,502 5 10	837,682
Westminster	18,663 1 5	26,850
British	18,349 10 0	648,774
Union	18,212 10 1	235,567
London	13,259 13 2	150,807
York and London	11,584 15 4	600,209
Hand-in-Hand	10,996 2 2	—
Licensed Victuallers	5,210 9 10	—
Protestant Dissenters	3,840 15 8	74,485
Independent and West Middlesex	2,073 6 7	76,700
Benevolent	13 3 2	—

* Offices in London, No. 449, WEST STRAND, and No. 78, KING WILLIAM-STREET, CITY, where Insurances may be effected against Fire on the most liberal terms.
No charge made for Policies, or for Alterations and Removals. —Insurances effected for Seven Years charged Six Years only.— The Rates required by the Scottish Union Life Office on Young and Middle-aged Lives are considerably lower than those charged by most other Offices.

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The Directors hereby give notice to Members whose Premiums fall due on the 5th of October next, that the same must be paid within thirty days from that date.
The premiums are payable yearly, half-yearly or quarterly, on the 5th of January, 5th of April, 5th of July, and 5th of October, either of which several days constitutes the commencement of the year to Members. Persons, therefore, desirous of entering the Society, as Members, on the 5th of October next, should appear at the Office on or before that day.
Examples of the abatement of Forty per cent. already allowed on Members' Policies of Five Years' standing.

Date of Policy.	Age.	Sum Assured.	Annual Premium paid for first 5 years.	Premium on sixth payment.	Reduction of Premium 6th year.	would assure, at the increased age of the party.
1835.		£	£. s. d.	£. s. d.	£. s. d.	£.
5th Jan.	36	3000	88 12 6	53 3 6	35 9 0	1035
	56	2000	113 6 8	68 0 0	45 6 8	663
	62	1000	71 8 4	42 17 0	28 11 4	320
10th March,	30	1000	24 17 6	14 18 6	9 19 0	345
	41	5000	171 0 10	102 12 6	68 8 4	1665
	50	3000	141 15 0	85 1 0	56 14 0	1040

The above shows a result admitting of advantageous comparison with any other institution for Life Assurance. All Members' Assurances effected during the year 1835 and the early part of 1836, have received the above rate of abatement, which has been made upon data justifying a confident expectation that the same reduction at least will be continued to those Members, and that all others, after having paid five annual premiums, will become entitled to an equal abatement.
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Premium for assuring 100*l.*

Age.	£ s. d.	Age.	£ s. d.	Age.	£ s. d.
25	1 18 6	35	2 10 11	45	3 9 4
30	2 4 4	40	2 18 8	50	4 4 2

Deferred Annuities Department.
By the plan exclusively developed by the Society, a single Deferred Annuity is made, not only to answer the same object, but to equal in amount the entire sum of all the advantages heretofore only obtained by the middle and industrious classes by separate investments in Savings Banks, Benefit Societies, and Loan Banks.
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EDINBURGH REVIEW, No. 145.— ADVERTISEMENTS intended for insertion in this forthcoming Number of the Edinburgh Review are requested to be sent to the Publishers on or before TUESDAY, Sept. 29; and BILLS on or before FRIDAY, October 2.
39, Paternoster-row.

THE QUARTERLY REVIEW, No. CXXXII., is published THIS DAY.
Contents:
I. The Fine Arts in Florence.
II. Acland on the Plain of Troy.
III. Modern English Poetesses—Mrs. Norton—Miss Barrett—Lady Emmeline Wortley—Mrs. Brooke, &c. &c. &c.
IV. Wrangell's Expedition on the Polar Sea.
V. Works of Thomas Carlyle—Chartism—French Revolution, &c.
VI. Life of Niebuhr, the Historian.
VII. The Crown Prince George of Hanover on Music.
VIII. Memoirs of Sir Samuel Romilly.
John Murray, Albemarle-street.

On Wednesday next will be published,
THE ECLECTIC REVIEW for OCTOBER.
Contents:
1. Memoirs of Sir Samuel Romilly.
2. Murray's Truth of Revelation Demonstrated.
3. Lieber's Manual of Political Ethics.
4. The Epistle to the Romans—Haldane and Chambers.
5. Religious Persecution in Madagascar.
6. Pascal.
7. The Claims of Home and Colonial Missions.
8. The Niger Expedition.
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This day is published,
BRITISH AND FOREIGN REVIEW, No. XXI.
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2. Austria and her Resources—Milan Treaty.
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4. Montenegro.
5. British Administration of India.
6. Medical Reform.
7. History of Fiction—Eastern Story-Tellers.
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By HENRY MELVILL, B.D.
Minister of Camden Chapel, Camberwell; and late Fellow and Tutor of St. Peter's College, Cambridge.
Rivingtons, St. Paul's Churchyard, and Waterloo-place.

LONDON, SATURDAY, SEPTEMBER 26, 1840.

TENTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

[*From our own Correspondents.*]

THURSDAY, SEPTEMBER 17.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

President—Prof. FORBES.

Vice-Presidents—G. B. AIRY, Esq., Astron. Royal, Rev. Prof. WHEWELL, Prof. J. THOMSON.

Secretaries—Prof. STEVELLY, Rev. Dr. FORBES, Mr. A. SMITH.

Committee—Dr. Neill Arnot, Dr. Anderson, Mr. F. Baily, Sir D. Brewster, Sir T. Brisbane, Mr. J. Caldecott, Prof. Duncan, Mr. J. P. Espy (Philadelphia), Prof. Encke (Berlin), Mr. T. Galloway, Capt. Johnson, R.N., Rev. Prof. Kelland, Dr. Lamont (Munich), Prof. Nichol, Mr. A. F. Osler, Mr. J. Phillips, Capt. R. E. Pringle, Rev. Dr. Robinson, Mr. J. S. Russell, Major Sabine, Col. Sykes, Mr. W. F. Talbot, Prof. Wallace, Prof. Wheatstone, Prof. Willis.

THE PRESIDENT, on taking the chair, observed that the ordinary course pursued on opening the Section was to call on those who had been appointed at previous meetings to draw up reports, to say whether those reports were now ready, or what progress had been made. In conformity with this practice, he begged to know from Major Sabine whether the Report on Magnetism, by Sir John Herschel, had arrived.

Major SABINE replied that it had not, but as soon as it reached him he would communicate it to the Section.—Major Sabine then presented his 'Report on the Translation of Foreign Memoirs.'—At the Meeting of the British Association at Newcastle, in 1838, a Committee was appointed for the purpose of procuring and publishing translations of foreign scientific memoirs, and a sum of 100*l.* was placed at their disposal: and at the Meeting at Birmingham, 1839, a further sum of 100*l.* was allotted for the same object. The memoirs translated in the first year, under the superintendence of the Committee, and at the expense of the Association, were:—

1. 'Remarks on the advancement of Magnetical Observatories, and a Description of the Instruments to be placed in them,' (with one plate,) by Weber.
2. 'Method to be pursued during the Magnetical Term Observations,' by Gauss.
3. Extract from the Daily Observations of Magnetic Declination, during Three Years at Göttingen, by Gauss.
4. Description of a small Portable Apparatus for Measuring the Absolute Intensity of Terrestrial Magnetism, (with one plate,) by Weber.
5. 'On the Graphical Representation of the Magnetic Term Observations,' (with two plates,) by Gauss.

For the translation and publication of these in Taylor's Scientific Memoirs, the first year's grant of 100*l.* was paid to Mr. Taylor. In the present year Ohm's memoir, entitled, 'The Galvanic Circuit investigated Mathematically,' has been translated at the expense of the Association, and given to Mr. Taylor, for the seventh and eighth numbers of the 'Scientific Memoirs.' The Association have also paid for seven plates, representing the lines of magnetic declination, inclination, and intensity, computed by M. Gauss's theory. The sums paid for these plates, and for the translation of Ohm's Memoir and the plate which accompanies it, amount to 63*l.*, which is the whole charge for the present year. The Committee stated that translations have been gratuitously presented to the Committee, of the seven undermentioned memoirs on magnetical instruments and on subjects of prominent interest in mathematical and physical science:

1. Gauss 'On a New instrument for the Direct Observation of the Changes of the Intensity in the Horizontal Portion of the Terrestrial Magnetic Force.'
2. Weber 'On the Arrangement and Use of the Bifilar Magnetometer.'
3. Gauss, 'General Theory of Terrestrial Magnetism.'
4. Encke 'On the Method of Least Squares.'
5. Bessel 'On the Determination of the Axes of the Elliptic Spheroid of Revolution which most nearly corresponds to the Existing Measurements of Arcs of the Meridian.'
6. Weber, 'Description and Use of a Transportable Magnetometer.'
7. Bessel 'On the Barometrical Measurement of Heights.'

The Committee placed these translations in the hands of Mr. Taylor, by whom they have been printed in the sixth, seventh, and eighth numbers of the 'Scientific Memoirs.' The Committee further acknowledged the receipt of a translation of Rudberg's 'Experiments on the Expansion of Air,' gratuitously presented by Prof. Miller, of Cambridge. This translation has also been placed in Mr. Taylor's hands, and makes a part of the eighth number of the 'Scientific Memoirs.'

In the absence of Prof. Powell, Prof. Whewell laid before the Section an abstract of 'Prof. Powell's Report on Radiant Heat.' This report was supplementary to one furnished by Prof. Powell to the Association at the Oxford Meeting, in 1832, and he now proposed to give an account of the progress of discovery since that period. Such a report was peculiarly required, from the number and importance of the results arrived at in the interval, which, though not sufficient to form the basis of an unexceptionable theory, have at least tended greatly to modify previous opinions, and to enable us to refer large classes of phenomena to something like a simple and common principle. The former report was divided into various heads, derived from what appeared in the then existing state of our knowledge well-marked distinctions between several kinds of effects ascribed to radiant heat: but recent discoveries have in a great degree so changed our views on the subject, that these divisions cannot with any advantage or convenience be adhered to. One principle of arrangement, however, has been newly supplied in the discovery of the polarization of heat; so that all the researches to be described may be conveniently classed under two heads,—1st, as they relate to heat in its *ordinary* or *unpolarized* state; 2ndly, as they relate to *polarized heat*. The Report then entered on the first general head, by calling attention to the recent researches of Melloni and Forbes, respecting the *transmission* and *refraction* of heat. The Professor adverted to the discovery of Melloni, that the resistance to the passage of heat is *not* exerted at the surface, but in the interior of the mass. This was a result of the observation, that the difference between the transmission of heat from a more highly heated source and from a less highly heated source became less as the thickness of the screen was diminished, and disappeared when very thin screens were interposed. By comparing the transmissive powers of a great number of substances, he found that in crystallized bodies the diathermaneity for the rays of a lamp was proportional to their refractive powers; but in uncrystallized bodies no such law could be traced. It was in the course of these researches that Melloni made the important discovery of the singular property possessed by rock-salt,—viz., that it is almost entirely permeable to heat, even from non-luminous sources. He found its transmissive power six or eight times greater than that of an equal thickness of alum, which had nearly the same transparency and refractive power; and that, unlike other diathermanous media, it is *equally* diathermanous to every species of heat, *i. e.* whether from sources highly heated or moderately heated; thus, he found a plate of 7 millimetres (.28 inch) thick to transmit 92 out of 100 rays, whether from flame, red hot iron, water at 212° or at 120° Fah. A plate one inch thick gave a similar constant ratio: the general conclusion being, that the source being a lamp, the diathermancy is not proportional to the transparency; and he makes some general remarks on these results, as related to those of Seebeck, on prismatic dispersion. In a supplementary paper, Melloni investigates the modifications which calorific transmission undergoes in consequence of the radiating source being changed. He employs four sources of heat,—1, a Locatelli lamp; 2, incandescent platina; 3, copper heated by flame to about 730° Fah.; 4, hot water in a blackened copper vessel. The discovery of the complete diathermancy of rock-salt furnished the means of prosecuting the author's researches on the refraction of heat. In the successful experiment which he made, he concentrated in the focus of a rock-salt lens, the rays of dark heat from hot copper and hot water. A similar lens of alum produced no effect, which proves that the effect is not due to the mere heating of the central part of the lens. In discussing the properties of the calorific rays immediately transmitted by different bodies, a remarkable effect presented itself: the rays of the lamp were thrown upon screens of different substances in such a manner that, either by changing the distances or by concentration with a mirror or a lens of rock-salt, the effect transmitted from all the sources was of a certain constant amount. This constant radiation was then intercepted by a plate of alum, and it was found that very different proportions of heat were transmitted by the alum in the different cases; from whence he (Melloni) concludes "that the calorific rays issuing from the diaphanous screens are of different qualities, and possess (if we may use the term,) the diathermancy peculiar to each of the substances through which they have passed." He next investigated the effects of *coloured glasses*, and concludes, that all the coloured glasses except green produce no "elective action" on heat: green glass, on the contrary, transmits rays more easily stopped than the others: and that green glass is the only kind which possesses a coloration for heat (if we may use the term), the others acting upon it only as more or less transparent glass of uniform tint does upon light. From experiments upon the solar rays transmitted by green glass, and intercepted by other media, he found they passed copiously through rock-salt, but feebly through alum; whence he concludes, that there are among the solar rays some which resemble those of terrestrial heat, and in general that the differences observed between solar and terrestrial heat, as to their properties of transmission, are therefore to be attributed merely to the mixture in different proportions of these several species of rays. Prof. Forbes repeated and extended Melloni's experiments on the transmission and refraction of heat. One of the most interesting points to which he directed his attention was the possibility of detecting heat in the moon's beams. These, concentrated by a polyzonal lens of thirty-two inches diameter, and acting on the thermo-multiplier, gave no indication of any effect: so that Prof. Forbes considers it certain that, if there be any heat, it must be less than the $\frac{1}{300000}$th part of a degree Centigrade. In his third section he investigates the index of refraction for heat of different kinds as compared with that for light in the same medium. The method of observation adopted was indirect, depending upon the determination of the critical angle of total internal reflection in a rock-salt prism with two angles of 40° and one of 100°. By an ingenious mechanical contrivance, the sentient surface of the pile was made to receive rays coming from the source of heat after undergoing two refractions and one reflection, whatever was the angle of incidence. The results, which were but approximate, were as follows:—

Source of Heat.	Index of Refraction for Rock-salt.
Locatelli Lamp	1.521
Do. transmitted through Alum ..	1.548
.. .. Glass	1.537
.. .. Opaque Glass ..	1.543
.. .. Opaque Mica ..	1.533
Incandescent Platina	1.522
Do. transmitted by Glass	1.538
.. .. Opaque Mica ..	1.534
Brass at 700°	1.518
Do. transmitted by Clear Mica ..	1.527
Mercury at 450°	1.522
Mean luminous rays	1.552

The results deduced are:—

1. The mean quality, or that of the more abundant proportion of the heat from different sources, varies within narrow limits of refrangibility.

2. These limits are very narrow indeed where the direct heat of any source is employed.

3. All interposed media (including those impermeable to light), so far as tried, *raise* the index of refraction.

4. All the refrangibilities are inferior to that of the mean luminous rays.

5. The limits of dispersion are open to further inquiry, but the dispersion in the case of sources of low temperature, appears to be smaller than that from luminous sources.

The report then went on to the researches of Melloni on the reflection of heat; and the analogies of light and heat, as traced by Forbes and Melloni. He dissents from the opinion of Ampère, that the difference between heat and light is to be accounted for by the difference of wave length on the undulatory hypothesis. During these researches, he found that a certain kind of green glass coloured by oxide of copper, though it permitted a portion of luminous rays to pass, absorbed all the calorific rays, so that it exhibited no calorific action, capable of being rendered perceptible by the most delicate thermoscope, even when so concentrated by lenses, as to rival the direct rays of the sun in brilliancy. With respect to the transmission of heat by screens, Prof. Forbes remarked, that Melloni's view of the transmission of heat of low temperature, by all substances alike, is equivalent to saying that substances in general allow

only the more refrangible rays to pass, or that while rock-salt presents the analogy of white glass, by transmitting all rays in equal proportions, every substance hitherto examined acted on the calorific rays as violet or blue glass does on light, absorbing the rays of least refrangibility, and transmitting the others only. To this rule, Melloni made out the first exception, or the first analogue to red glass—rock-salt with its surface smoked. And Prof. Forbes soon after pointed out another, viz. mica split by heat into numerous fine laminæ, and from hence, as the effect was obviously mechanical, since unlaminated mica produces no such effect, he concludes that the smoked surface of the rock-salt acted also mechanically, and was thus led to try the effects of surfaces variously altered by mechanical means, and thus effects, in some distant degree analogous to *sifting* the heat, were observed. Fine powders also sifted on the surface, were found to affect the transmission of heat; and these Prof. Forbes considered analogous to diffraction and periodic colours in light. From these important researches, we have learned to connect modifications in the transmission of heat with the quality of refrangibility, and not as heretofore with a supposed difference of quality depending on the *source* of the heat. The report then gave an account of the researches of Dr. Hudson on radiation of heat, those of President Bache and Stark on the influence of colour and surface on radiation, and Prof. Powell's experiments upon the repulsive power of heat; and adverted to Mr. Farquharson's theory of the formation of ice at the bottom of rivers, as a result from radiant heat. From this opinion, Prof. Powell dissents. The report then proceeds to the second division, on polarized heat, under which a detailed history of the several successive discoveries of Prof. Forbes on this subject was minutely given, with the dates of the several stages of the discoveries. Melloni having failed in repeating the experiments of Berard in polarizing heat by the tourmaline, and Nobili having in vain attempted it by reflection, Mrs. Somerville in her 'Connexion of the Physical Sciences,' 2nd edition, speaks of it as altogether without experimental proof. In November 1834, Prof. Forbes took up the subject, and obtained complete success. He succeeded in polarizing heat from various sources, and by the aid of various substances, as piles of plates of mica, and by reflection and refraction, and showed that the peculiar modification of the experiments adopted by Berard, by reflection from glass, the quantity even at the maximum which could reach the thermoscope after two reflections, would be so extremely small, as that no difference of effect in the two rectangular positions could really have been perceptible. The entire series of those discoveries was completed between November 1834 and January 1835, the main practical improvement (which led to all the rest of the discoveries,) being the employment of the piles of mica. Prof. Forbes being at Paris in the summer of 1835, and finding both Biot and Melloni sceptical as to these results, he exhibited them to those philosophers with mica piles, which he prepared for the occasion, and which he left with Melloni. The next subject entered upon by Prof. Forbes was, that of circular and elliptic polarization. This he determined both by depolarization, and also by the internal reflection of heat in a rhomb of rock-salt, as in the analogous cases of circular polarization of light. The report then adverted to the researches of Melloni on polarized heat, and entered minutely into historical details, and the theoretic views of the author; and then pointed out some expressions in Dr. Thomson's work on heat, which might lead a person, who did not carefully attend to dates and facts, to attribute the priority of discovery to Melloni, and thus to deprive Prof. Forbes of a portion of his well-earned fame; and which was so clearly his due, that in 1836 the Keith prize had been awarded to him by the Royal Society of Edinburgh, after a close examination of the researches and experiments by the council; and subsequently the Rumford medal was adjudged to him by the Royal Society of London, after similar precautions. The later researches of Forbes and Melloni on this subject related to the connexion of these discoveries, and the facts thus developed, with the undulatory theory. The report contained some remarks on the clearness with which the chronological order of the discoveries is marked in this case, and the consequent impossibility of any of those disputes which have sometimes tended to disturb the harmony of scientific inquiries. The continental philosophers have the merit of devising and bringing to perfection the instrument by the aid of which alone, any discoveries in this very delicate field of research could have been expected. Prof. Forbes is the author of the discovery of the polarization of heat in all its branches, and from all its sources. The report concluded, by drawing attention to the difference which exists between Prof. Forbes and the continental philosophers, as to the equal or unequal polarization of heat from different sources, and to the speculations respecting the cause of the variety of action of light and heat on our organs of sense, while both originate in undulations of the molecules of the same ethereal medium.

Prof. Forbes stated, that with respect to the difference of opinion alluded to, he believed he might safely announce that it was at an end, as in a late interview which he had with those distinguished persons, the cause of the discrepancy, he believed, had been detected, and the question settled to the satisfaction of all concerned.—Prof. Stevelly inquired of Prof. Forbes, how, if these researches should lead to the adoption of the undulatory theory for heat as well as for light, that hypothesis could be reconciled with the quantitative measures of heat which chemistry forced upon our notice? for although the density of light might be treated as a quantity, yet he did not see how colour, to which heat was thus rendered analogous, could.—Prof. Forbes said, that in his researches, he had not at all entered into the discussion of the facts, with a view either to the establishment or disproof of any physical theory of the nature of heat, and although he had little doubt of the conclusion which these facts would ultimately force upon us, yet, as he saw Profs. Kelland and Whewell, and others present, who, by their attention to the mathematical investigations connected with these subjects, were so much better qualified to give an answer than he was, to them he begged to refer it.—Prof. Kelland said, that he had given some, but not much attention to the subject to which the question referred. He had no doubt but that the undulations were distinguished by something analogous to what had been called faces, and that while the undulation in a direction perpendicular to its direction of propagation, was a circular function, and therefore tended to compensate or return into itself, in the direction in which it was propagated; on the other hand it was not circular, and thus admitted of quantitative increase or diminution. Now, it was to the length of the wave in the direction of its propagation, that analogy would lead us to attribute its heating influence.—Prof. Whewell said, he was inclined to answer the question rather differently from Prof. Kelland, although that answer would be quite satisfactory, if the hypothesis of faces, or particular aspects of the heating rays, should be confirmed by other phenomena. The answer, however, which he should be inclined to give was, that before the difficulty was attempted to be met directly, we should settle what was meant by quantity of heat: what that was, in short, which our thermometers indicated; for his part, he conceived, that if our photometrical instruments had been fitted up to indicate degrees in the way that our thermometers are, we should have spoken just in the same way, and nearly in similar terms, of quantities of light, as we now do of quantities of heat, indicated in both cases by degrees; and since it was admitted that the one offered no solid barrier to the adoption of the undulatory theory of light, neither would the other be found, when examined strictly, to oppose in any formidable degree the undulatory theory of heat. In his opinion, the phenomena of conduction would be found to present a more serious objection to the application of the undulatory theory to heat. That undulations among an ether of such extreme tenuity as that of light or heat, should be propagated onwards in directions different from those in which the original radiant undulations were being propagated, and that by some influence of the grosser particles of bodies which must be supposed as it were imbedded in this fluid, was, he conceived, a difficulty which would require to be considered, but which he was, however, far from conceiving as insuperable. Ampère's theory, he conceived, removed these difficulties. He would beg to ask Prof. Forbes, how he accounted for the curious fact, that although the length of the wave of heat was nearly three times that of light, yet their refractive indices were so nearly the same?—Prof. Forbes replied, that a communication from Prof. Powell, which was among the list of papers to be read in this day's proceedings, would give an answer to the inquiry of Prof. Whewell; and, therefore, if the Section would permit him to change the order in which it was set down, he would lay it now before them, and thus keep the subjects continuous.

'On a Point in the Wave-theory as applied to Heat,' by Prof. Powell.

According to M. Cauchy's theory, the relation between the refractive index and the wave length, is expressed by the formula,

$$\frac{1}{\mu^2}=\mathrm{P}-\mathrm{Q}\left\{\frac{\pi\Delta x}{\lambda}\right\}^2+\mathrm{R}\left\{\frac{\pi\Delta x}{\lambda}\right\}^4-\text{\&c.}$$

And when λ is very great compared with Δx, this expression is reduced to its limiting value:

$$\frac{1}{\mu^2}=\mathrm{P}, \text{ or } \mu=\frac{1}{\sqrt{\mathrm{P}}}$$

This forms the limit of refraction for rays of *all* wave-lengths, *whether of light or of heat.* And as the value approaches this limit, considerable changes in λ will correspond only to small changes in μ. This deduction is obvious, and has been before made. The limit is easily determined from Mr. Kelland's calculation for all the media examined by Fraünhofer; thus, e. g. for flint glass, No. 13, we have

For the ray B . . . . $\mu_{\mathrm{B}} = 1.6277$

For the limit . . . . . $\mu_{\infty} = 1.6090$

The present object is to remark the bearing of this point on the theory of *heat.* If this theory be true, all refraction of heat ought to fall within this limit, and probably a considerable portion of the heating rays would have an index not far removed from it. It will be particularly interesting to calculate it for rock-salt and other diathermanous media, and compare it with the index of the heating rays. The data for rock-salt are given in my report on refractive indices, British Association Reports, 1839. This consideration also explains a difficulty which occurred to Prof. Forbes, who, in his third series of researches, (Section 2, No. 45, 46,) having arrived at the conclusion, that a wave of heat has a length nearly three times that of red light, regards this as a startling inference, and difficult to reconcile with the small difference existing between the index of refraction for heat and for light. This is just what should result on the above theory.

Sir David Brewster said, there was another inquiry connected with the subject now under discussion, which he would beg to press on the attention of Prof. Forbes, and others who were engaged in experimental researches in this branch of physics. He should be glad to have it determined, whether any phenomena among those connected with heat were analogous to those of opalescence with respect to light. The latter were interesting and important; the intimate particles of bodies were found occasionally to exercise an important action upon light: thus, light transmitted through the fluor spar of Alston Moor was acted upon by the internal particles of these crystals, so that the blue light was abundantly reflected, and an opalescence was thus caused. The alcoholic solution, also, of many vegetables, was found to exhibit a similar effect; thus, the alcoholic solution of laurel leaves cut up, when placed in a square cut phial of clear glass, was found, when looked at in such a position as that the rays had to pass through a thick mass of the fluid, to return the red rays very abundantly, giving the entire mass of fluid a tinge of that shade, and this effect seemed to be strictly analogous to opalescence. Tabasheer was also found to be opalescent for blue light; and there were many other examples which he might cite.—Prof. Forbes replied, that he considered there were phenomena connected with heat, which bore a very close analogy to opalescence in regard to light; thus, the phenomena of mica, reduced to very thin superimposed plates, by the action of heat, he considered to be strictly analogous; also the action of smoked surfaces on heat, and surfaces covered with other powders, besides carbon, in a finely divided state, he conceived would be found to belong to the same class.—Sir David Brewster thought, that in the case of light the effect depended upon a decomposing influence exerted upon

the light by the molecules of the opalescent body through which it was passing; thus, by placing a small quantity of oil of cassia between plates of glass, a decomposing influence was exercised upon the light, and an opalescent effect resulted. Also, when white soap was rubbed between two glass plates, the influence of the interstices which were left between the soapy particles, and which were occupied by air, produced a decomposing effect, when resulted colours, as he conceived, analogous in their origin to opalescence.

Prof. Forbes now gave an abstract of his Supplementary Report on Meteorology. At the last meeting of the Association, he had been requested to make a report on the progress of meteorology since the period of his former Report, which was drawn up in 1833. In obedience to that request he now came before them. He had distributed the matter of this report under the same general heads as those under which he had formerly treated of the several subjects. These were Temperature, Pressure, Humidity, Wind, Clouds, Rain, Electricity, Meteors, and suggestions on the first of these heads. In the report, he had entered fully into the subject of the instruments used for measuring temperature, with their improvements, defects, and the cautions to be observed in using them. He enlarged on the decrease and accumulation of heat, and the curves which were used for elucidating these subjects. He spoke of the temperature decreasing in a geometrical series as you ascend through arithmetically increasing heights, the temperature being supposed constant, and entered on an examination of the paradoxical conclusion at which Poisson had arrived, that the upper surface of the atmosphere was, in consequence of the extreme cold there existing, in a state which he termed liquefaction. He observed, that there were reasons for concluding that the temperature of space itself entirely beyond the atmosphere of the earth, was not so cold as Poisson seemed to suppose the highest portions of our atmosphere; but that, independent of this opinion, there were other causes in operation quite sufficient to limit the extent of the atmosphere, without the aid of this startling supposition, and which limited height might be considered as almost established, since Wollaston's proofs derived from the two entirely unconnected sources of astronomical and chemical phenomena. He then glanced briefly at the subject of isothermal lines, and passed on to the subject of solar radiation. He examined at great length the researches of Poisson on this subject, and pointed out what he considered the inadequacy of his speculations on what may be called the astronomical part of the total influence. The chief point insisted on in this branch was, the neglect of Poisson to take into calculation the influence of the earth's atmosphere in diminishing the heating power of the sun's rays, particularly when they entered it obliquely. This he showed to be most important, by stating the fact, that at Paris the influence of the atmosphere upon rays entering vertically, being to reduce their heating influence by 25 per cent. of what it would have been had they not passed through it; when they entered so obliquely as to form an angle of 25° with the horizon, their heating influence was reduced to one-half; and when an angle of 5°, to one-twentieth part. If Poisson's views were correct, the total solar influence at Paris would be 24° Centigrade; and as the mean temperature of Paris is 11°, this would leave about 13°, or about 9° of Fah., as the temperature, irrespective of the sun's heat; whereas the mean temperature of the polar parts of the earth, which are so far from being totally deprived of solar influence, that they are alternately under that influence and deprived of it, is no higher than about 32°. He then proceeded to the consideration of the temperature of the earth below the surface—gave a sketch of the results of former experiments, originating in those made in the caves under the Observatory at Paris—detailed the results of those lately made, and promised, before the Association concluded its present sittings, to bring this subject again before the meeting, in connexion with the experiments made at Edinburgh. Then he glanced rapidly at the subject of mean temperature, and showed, that while within the tropics it was sufficient to plunge a thermometer a foot under the surface of the earth, in order to get by its mean indication the mean temperature of the place, in higher latitudes this would not be sufficient; and he detailed the circumstances producing the difference, and pointed out the methods and precautions necessary for obtaining it. He then entered on the consideration of the temperature of space beyond the earth, and stated the probable source of it to be the radiating influence of the stars. Under the head of Pressure, the barometer, its construction and proper use, came under consideration. He pointed out the use of curves in recording and comparing its indications—the great variety of its oscillations in the several parts of the earth, and alluded to the importance of accurate registers of its indications being kept,—alluding to the value of the hourly observations recorded, for so many years, under the inspection of Mr. Snow Harris, at Plymouth, and those at Leith and other places in Scotland, under the inspection of Sir D. Brewster. He next alluded to a fact which seems to lead to the inference, that we must repose less confidence in the barometer, as a means of measuring heights, than has been heretofore supposed. It has been found by actually levelling between the Black Sea and the Caspian, that the latter was only 82 feet below the level of the former; whereas barometric measurements, founded on previous determinations, since carefully repeated, gave, in consequence of some as yet unknown anomaly, the difference of 320 feet. The Humidity of the atmosphere was the next topic discussed. As to the amount of vapour in the atmosphere, at any one instant, he considered that by the researches of Dr. Apjohn, begun at the suggestion of the Association, the important problem of the wet-bulb thermometer had been completely solved, and meteorologists thus put in possession of a simple, and at the same time most effective, instrument. The subject of the distribution of humidity in the atmosphere was next briefly touched on. Under the head of Wind, he alluded to the theory of Dove, which he said was comparatively unknown in these countries; and briefly spoke of the researches of Lieut.-Col. Reid, Mr. Redfield, and Mr. Espy. He then passed over the heads Clouds and Rain, promising, on a future day, to bring forward some facts connected with extraordinary falls of rain which had been observed; but which, as stated by him, in one instance in his former report, had been called in question during his absence. On the subject of Electricity, he observed, that little had been added either to our instrumental resources, or to our knowledge of the subject, since his former report. On the subject of Meteors, the report contained all that had been added to our knowledge on the subject of the unusually numerous appearance of those which had been seen on the 12th and 13th of November, and 10th August, for some years; and concluded by pointing out the advantages of public meteorological observatories, for the purpose of 1st, determining laws; 2nd, keeping, and under proper regulations suffering to be inspected, standard instuments; 3rd, making and recording observations, in number and with a regularity not to be expected, and scarcely ever obtained, in observatories maintained by individuals. Private stationary observations were next noticed, and suggestions thrown out; and lastly, travelling observations.

A report was then read, 'On the application of a portion of the sum of 50*l*., voted by the British Association at its meeting at Birmingham, in 1839, for Discussion of Tide Observations, and placed at the disposal of the Rev. W. Whewell.'

A portion of this sum has been expended upon calculations, having for their object to determine the effect of the moon's declination upon the tides. The determination of this correction is attended with peculiar difficulties, and has hitherto been incompletely effected. These difficulties arise from this: that the moon's mean declination is different in different years, through a cycle of eighteen years, the period of revolution of her nodes. The inclination of her orbit to the equator varies from about 18° 20', its amount in 1829 and 1830, to 28° 40', its amount in 1837 and 1838. Hence, if we attempt to determine the declination correction (of height, for instance) by taking the difference of the height from the mean height (allowance being made for other corrections), we refer to a variable standard. Accordingly, if we find from the observations the mean semimenstrual inequality for the successive years, it will be different in consequence of the different mean declinations in successive years; and it is only by taking a series of nine or more years that we can obtain the absolute mean semimenstrual inequality, and consequently the absolute correction for declination applicable to all years alike. This being known to be the case, I was disposed to take advantage of an opportunity which occurred of discussing a series of several years' tide observations, with a view to the verifying in fact these theoretical features of the correction tables, and determining the correction for declination. Mr. Dall, the Harbour Master at Leith, had made a series of tide observations, extending from 1827 to 1839, which I had every reason to believe to be accurate; and Mr. Ross, of the Hydrographer's office, had, for his own satisfaction, begun to arrange these observations, with a view to discussions relative to lunar declination and parallax. The latter gentleman undertook, at my request, to conduct his discussion in such a manner that it might bring into view such results as I have above described. The arrangement and discussion of thirteen years' observations of tides (involving the management of above 18,000 numbers given by observation, and double the number extracted from tables), was, of course, a business of very great labour and time; but as this task was not originally suggested by the British Association, nor directed exclusively to objects pointed out by it, I thought it my duty to confine my expenditure within a sum very disproportionate to the magnitude of the labour. Mr. Ross has been paid 20*l*. for his discussion of the above-mentioned heights, with a view to the declination correction. The result of this discussion is very nearly what I had anticipated. The semimenstrual lines taken for different years, differ by the effect of the different mean declination. Thus the correct mean of the height of high water for each hour of transit, is about six inches less in 1837 than in 1829, and this difference is balanced by a difference in the declination correction which is to be applied to this mean. The declination correction is greater in 1837 than in 1829 for equal declinations. The difference, however, is not constant, but increases with the declination, which agrees with what the theory indicates. The curves which express this correction, deviate considerably from each other at the higher declinations. This result suggests an improved method of applying the declination correction to tide observations, which, however, requires to be further considered and examined before it can be confidently recommended: I mean, a method of using a different semimenstrual inequality and different declination correction for every different period of the moon's nodes. On this subject it may hereafter be possible to speak more decidedly. W. Whewell.

Another portion of the sum placed at my disposal has been expended upon calculations and operations performed by Mr. Bunt. These calculations were in the first place directed to the determination of the form of the curve of rise and fall of the tides at Bristol. This determination was the more desirable, inasmuch as calculations were in progress at the Admiralty (under my directions) for the purpose of determining the form of the curve of rise and fall at Liverpool and at Plymouth. The results of these calculations have been laid before the Royal Society, and are now printed by them in the Philosophical Transactions, as the twelfth series of my Researches on the Tides. The accompanying communication from Mr. Bunt contains the result of his investigations on this subject. The thing principally discussed was the displacement of the summit of the curve of rise and fall; that is, the difference of the time of high water actually observed, and the time obtained by bisecting the interval between equal altitudes, before and after high water. The main object was, to refer this displacement to its proper argument. It was natural to suppose that it depended mainly upon the height of the tidal wave, and, consequently, upon the age of the moon; and hence would principally consist of a semimenstrual inequality. But by the discussions, it appears that there is, besides this fact, one which depends upon the solar parallax, and also others. This would lead, as Mr. Bunt remarks, to a suspicion that meteorological causes are concerned in producing the result; the subject however is as yet not free from difficulty. I have also employed Mr. Bunt in other discussions, with a view to further improvements in our knowledge of the laws of the tides, especially with reference to two

points:—the determination of the best anterior epoch, or period, at which that anterior transit of the moon is to be assumed which governs the tide:—and the solar corrections for parallax and declination. The excellence of the Bristol observations made with Mr. Bunt's machine, and of his modes of discussing the observations, induce me to believe that some progress may still be made in this inquiry; but the investigation is not yet completed. I have also taken the liberty of directing Mr. Bunt to perform an operation not precisely included in the terms of the grant made to me for the present year, but closely connected with it, and forming an almost necessary sequel to a large operation performed at the expense of the Association in preceding years; I mean, a repetition of the levelling of a portion of the level line in the neighbourhood of the recent landslip in Devonshire. The southern extremity of the line levelled from the Bristol Channel to the English Channel is at Axmouth. When the great landslip took place in that neighbourhood, it might naturally be suspected that a part of the level line might be disturbed. A moment's reflection made this appear improbable, since the movement seemed to be confined to the chalk and the clay below it; whereas the terminus of the level line was bedded in the red marl. Still, if the movement of the ground were the result of an earthquake, even the inferior strata might have been slightly stirred; and this appeared to be exactly one of the cases, the decision of which was contemplated in the project of the level line. I therefore requested Mr. Bunt to repeat the levelling of the line from the mark in the church tower, in the village of Axmouth, down to the shore, where is the granite block which forms the terminus of the line, a distance of $\frac{3}{7}$ths of a mile. In July of the present year this operation was performed (with the same instruments as before), and it appeared that the mark in the church tower was above the mark in the block .... 5.8836 feet, which in July 1838 had been found to be, 5.8805 feet. The difference, $\frac{1}{27}$th of an inch, may be considered as a proof that there has been no sensible change. Mr. Bunt also levelled from the granite block, about 230 yards, to another bench mark eastwards, or towards the landslip, but found no difference of any importance. The expense of this operation, 10*l.*, I have taken the liberty of including in the account for tide discussions. W. Whewell.

I should wish, Mr. Whewell added, to have a grant of 50*l.* made to me for further tide discussions.

Mr. Bell, of Edinburgh, begged to inquire from Prof. Whewell whether the effect of the varying pressure of the atmosphere upon the tides had been ever observed: for it is manifest that if there were a difference of one inch of barometric pressure upon two distant parts of the ocean, say 1,000 miles apart, the difference of water level to compensate this should be over thirteen inches.—Mr. Whewell replied, that Mr. Lubbock, in his tide observations at Liverpool, had observed, and M. Daussy had long since noticed it.

The President inquired whether Mr. Graham was present, and ready to read a paper on his method of approximating to the value of the roots of numerical equations. Mr. Graham not being present, the President requested Prof. J. Thomson to give a slight sketch of Mr. Graham's method.

Prof. Thomson said, that he had examined the paper of Mr. Graham, and considered it to be correct in principle, but did not conceive that the method was so convenient as the method of solving numerical equations published many years since by the late Mr. Horner. Mr. Graham's method consisted of transposing all the terms but one to the same side of the equations, dividing by the co-efficient of the power of the unknown quantity involved in that, and extracting that root of both sides, which the index of the unknown quantity denoted; then substituting for x a first limit, a second was obtained, and so on *ad libitum*. Prof. Thomson exhibited the same question worked by the method of Mr. Horner and by Mr. Graham.—Mr. Smith said that it appeared to him the method was essentially defective, in that it only gave one of the roots of the equation. Mr. Smith then stated one or two curious properties of the roots of symmetrical functions, and showed that there are some cases extended to functions which were not symmetrical.

Section B.—CHEMISTRY AND MINERALOGY.

President—Dr. T. Thomson.
Vice-Presidents—Prof. T. Graham, Prof. Johnston.
Secretaries—Dr. R. D. Thomson, Dr. T. Clark, Dr. L. Playfair.
Committee—Prof. Bunsen (Marburg), Mr. W. Crum, Dr. Ettling (Giessen), Dr. Redtenbacher, Messrs. R. Mallet, R. M'Gregor, F. Penny, Dr. G. O. Rees, Prof. Schubarth (Berlin), Messrs. E. Solly, J. Tennant, Dr. Varrentrapp (Frankfort).

Prof. Schönbein, on some Electrical Phenomena.—It is well known to electricians that in certain electro-chemical decompositions a peculiar odour is evolved, very analogous to that produced by common electric sparks, or by the working of an ordinary electrical machine, in the air. M. Schönbein has undertaken a series of experiments, in order to ascertain the circumstances under which this electro-chemical odour is evolved, the causes which influence its production, and, if possible, the principle to which its appearance is to be attributed. This peculiar odour is evolved at the anode or positive surface, when certain aqueous solutions are decomposed by the passage of a voltaic current. The oxygen gas which is then evolved has a strong and peculiar smell, which is perfectly similar to that which is always perceived when an electrical machine is worked, or sparks passed through the air. M. Schönbein has observed that the odour is evolved on the decomposition of water, dilute sulphuric acid, solutions of phosphoric and nitric acid, potassa, and many oxysalts; dilute sulphuric acid yielding it in the greatest quantity; whilst no smell whatever was perceived on the decomposition of solutions of hydracids, chlorides, bromides, or iodides, which not only did not evolve it themselves, but by their presence, even in small quantity, prevented its evolution from solutions which would otherwise have produced it abundantly. He found, on collecting the oxygen gas evolved at the anode, from a solution capable of evolving the odour, that the odour might be preserved for some time by enclosing the gas in well-stopped bottles. From the characters possessed by this oxygen, M. Schönbein was led to consider the odour due to the presence of a minute quantity of a new and hitherto wholly unknown substance, of considerable importance in many natural phenomena, and he has therefore named it from its most evident character Ozone. Its properties are briefly as follows: it is only evolved from solutions containing it, by perfectly clean electrodes of platinum or gold; whilst charcoal and the more oxidizable metals are unable to cause its appearance. It can only be obtained from a cold solution, as heat prevents its evolution. When a piece of one of the oxidizable metals, such as zinc, tin, iron, mercury, &c., or a few drops of solution of the protochloride of tin, or protosulphate of iron, are placed in a portion of oxygen impregnated with ozone, that peculiar substance is almost instantaneously absorbed; and the oxygen becomes inodorous. When perfectly clean and dry plates of gold or platinum are immersed in oxygen containing ozone, they acquire a negatively electric state of polarity; silver and copper also become thus electric, but in a far less degree than gold or platinum. The plates thus polarized retain their electric powers in air for a considerable time, but rapidly lose it, when plunged into hydrogen gas, in which, if retained a sufficient time, they acquire an opposite state, becoming positively polarized. M. Schönbein then compares these effects with those produced by the odorous matter peculiar to common electric sparks and brushes. When a perfectly clean and dry plate of gold or platinum is exposed to an electric brush issuing from a charged and conducting point, it becomes positively polarized, and the degree of polarity depends on the nature of the point and the time which the plate has been exposed to the influence of the brush issuing from it. He shows that the power is not due to the mere current of electricity escaping from the point, but to some substance produced or evolved by it; because if the point be moistened, the electricity still continues to be given off as a brush, but the power of polarizing the gold or platinum plates is lost. A plate thus charged is perfectly similar in its electrical powers to a plate charged or polarized by immersion in oxygen impregnated with ozone. Heat or exposure to hydrogen, which destroys or inverts the electricity of such a plate, exerts a precisely similar action on plates polarized by exposure to the brush; and likewise, if the plates are not perfectly clean and dry, it is equally impossible to charge them, either by exposure to the brush or by immersion in oxygen containing ozone. M. Schönbein supposes that there exists, both in the air and water, a very minute quantity of an electrolyte or compound substance, which, when decomposed by electricity, evolves, as one of its constituents, the peculiar odorous matter called ozone. He observes that both from its electromotive power, and likewise from its strong affinity for metals, it is evidently similar to chlorine, bromine and iodine. Its non-appearance, when water is decomposed by electrodes of the more oxidizable metals, he attributes to its entering immediately into combination with those metals; and he considers that when the solution is heated, the affinity of the ozone for metals is so much increased that it is even able to combine with gold and platinum, thus accounting for its disappearance when heated. By this theory, all the phenomena attendant on its evolution may be easily explained, and it hence becomes very interesting to search for traces of this widely diffused substance. M. Schönbein considers that the smell perceived whenever bodies are struck by lightning, is probably due to a small portion of ozone being set free, and relates a case of a church lately struck by lightning, which fell within his own observation, in which the surrounding buildings, to a considerable distance, were filled with a bluish vapour having a peculiar pungent odour. Even in this early stage of the inquiry it will readily be seen that many curious and unexplained phenomena might be accounted for, if the existence of the supposed electrolyte be proved. M. Schönbein proposes devoting all his leisure to the prosecution of this inquiry, in the details of which he is at present engaged.

Mr. E. Solly on Bleaching Vegetable Wax.—The author found that the best effect was produced by chlorine, but in this case it was necessary that the materials used to evolve the gas should be intimately mixed with wax, and then, of course, the difficulty of separating the residue occurred; and when a stream of chlorine was slowly passed through the wax, the process was very tedious; he subsequently found that strong nitric acid was a powerful decolorating agent, and it possessed the advantage of leaving no residue which was at all difficult of separation; but the expense of this process was a great objection to its use. The following method was ultimately employed: The wax was melted; a small quantity of sulphuric acid was poured in, composed of one part of oil of vitriol to two of water, and then a few crystals of nitrate of soda stirred in; the whole was then agitated with a wooden stirrer and kept heated. Nitric acid was thus evolved in considerable quantity and purity from a large surface, and in such a manner that all the acid evolved must necessarily pass through the melted wax. This method answered the purpose very completely, the process was cheap and rapid, and the residuum, being merely a little solution of sulphate of soda, was easily removed. When it is desired to employ chlorine in place of nitric acid as the bleaching agent, the same process may be adopted.

Prof. Gregory read a communication 'On the pre-existence of Urea in Uric Acid.'—By the action of peroxide of lead on uric acid, Liebig and Wöhler obtained from it oxalic acid, allantoine, and urea, and they considered the latter as existing in the uric acid, combined with urile. The author, having found that urea, unlike most organic substances, resists the oxidizing agency of permanganate of potash, thought, that if urea could be obtained from uric acid by the action of that salt, the argument for its pre-existence would be much strengthened; as, if only the elements of urea were present, the oxidizing agency of the permanganate would most likely prevent its formation. On trying the experiment, a large quantity of urea was obtained, along with oxalic acid, and a new acid, probably formed by the oxidation of allantoine. The author further described the acetate of urea, a salt which was formed in his experiments.

Prof. Gregory then exhibited a new process, communicated by Prof. Liebig, for preparing the very singular and beautiful compound termed murexide by Liebig and Wöhler, and purpurate of ammonia by Prout. The process is quite certain, and very productive. It consists in adding a boiling solution of 7 grains of aloxan and 4 grains of aloxantine in 240 grains of water, to 80 grains of a cold and strong

solution of carbonate of ammonia. The mixture instantly acquires a deep purple colour, and, on cooling, deposits the golden green crystals of murexide.

'On the relation of Form to Chemical Composition,' by Dr. Schafhaeutl.

The author stated, that he had, in a former communication, given a new method of procuring graphite, in which it was also shown that all graphites owed their origin to the operation of the same causes; namely, the contact of bitumen (or any similar substance) with a silicate, under a certain limited degree of heat; it was further maintained, that the compound nature of graphite might be satisfactorily demonstrated, by subjecting it to the action of hydrofluoric acid, which, combining with the silicon, liberated the carbon of the graphite as a hydruret, which was then consumed in the flame of a lamp. The object of the present paper was, to explain the circumstances under which certain modifications of form take place in this peculiar substance, (as also in others generally considered to be elementary,) and to prove their connexion with changes of an entirely chemical nature. A beautiful specimen of a formation of graphite was exhibited to the Section, obtained from the Neath Abbey Ironworks, in South Wales; it appeared to be composed of an infinite number of foliated scales overlapping each other, after the manner of the slates of a roof, each scale being so thin, as to be agitated by the slightest breath of air: a second specimen was exhibited of a graphite leaf, where it appeared as a globule of much greater size, the laminated structure still, however, existing in beautiful developement. In a third stage, the scaly structure disappeared; the globule having assumed a more porous and coke-like form. Dr. S. having premised an objection to any explanation of these curious changes of form, founded merely upon molecular alterations, proceeded to detail certain experiments, from which he deduced conclusions of an interesting and important nature. The discovery of a new mode of decomposing crystallized graphite, by heating it in concentrated boiling sulphuric acid, and adding a little concentrated nitric acid (see a description in the *Phil. Mag.* xvi., xvii.), afforded a series of singular and instructive phenomena. After the evolution of binoxide of nitrogen had ceased, each scale of graphite was converted into the globular substance before described; its external metallic lustre remaining unchanged, but its bulk so greatly enlarged, that what before appeared a single scale, became, by the separation and division of its component laminæ, a thick spongy tissue, capable of being restored to its former compressed foliated form, by the pressure of the finger nail. That this change of form, however, was not merely a mechanical effect, appears from the following experiment:—Graphite scales having been repeatedly treated with hydrochloric acid, washed, and again digested in a strong solution of caustic potash, in order to remove all possible mechanical admixtures of iron, silica and alumina, were then subjected to the process above described; the evolution of binoxide of nitrogen having ceased, an equal quantity of water was added to the mixture; immediately there succeeded a rapid evolution of bubbles from the globules of graphite, which at first lay at the bottom of the fluid; becoming lighter, as this evolution of bubbles proceeded, they gradually rose to the surface, when the gas immediately ceased to be evolved; the acid then, or the graphite, must have been combined with hyponitrous acid, which being decomposed by the water, was disengaged as binoxide of nitrogen. The globules when washed, dried, and weighed (at first weighing but 2.01 grs.), *had gained* 5.02 grs. in weight. Being then put into a flat covered dish of brass, and balanced accurately, the cover was removed, the globules immediately lost weight, and so rapidly, that in merely removing them from the dish, 0.18 grs. were lost; the dish was covered with a dew, apparently acid, as it acted on the brass. These globules, heated on paper until it became slightly tinged with yellow by the heat, now disengaged dense fumes, the paper being streaked with a blackish coloured smoke where it was in contact with the graphite; 2.30 grs. were lost during this process, which being repeated a second time, they were found to have lost 2.25 more. Finally ignited in a platinum crucible, dense fumes, without any perceptible odour, escaped, the weight of the globules being reduced to 1.86 grs. After which, no further reduction took place during ignition for half an hour in the open air. The total loss of the 2 grains thus experimented upon with the acid, was 6.96. In a paper by the author, (see *Philosophical Magazine*, cited above,) this loss was attributed to evolution of carbonic acid gas during this conjoined action of the acids; but it would appear from the last experiment, that there is formed a compound of sulphuric acid, nitric acid, carbon, hydrogen and oxygen, volatilized only at high temperatures. The question here arises, how can the rapid loss of weight be accounted for? During the previous drying process, which was conducted at 212°, the loss of water must have been accompanied by a change of chemical composition, and the new compound, by attracting water or oxygen when in the pan, must have formed an extremely volatile combination, evaporating as rapidly as it was formed. By a repetition of this treatment with the acid, graphite in the third stage, as before described, was obtained; the metallic lustre was entirely lost, as also the laminated texture; it now appearing as a porous mass, resembling coke, and no longer capable of reduction to its original foliated state by pressure, having undergone a decided chemical change. The acid solution deposited at once a copious precipitate of silica and alumina, (slightly tinged by oxide of iron,) upon the addition of ammonia to neutralization. A similar precipitate was obtained from the acid of the first experiments, but less in quantity, and requiring a longer time for its operation. Thus it would appear that the abstraction of silicon and the change of physical properties of graphite, are corresponding and mutually connected phenomena. In further proof of the necessary connexion of silicon as a chemical combination, essential to the existence of the scaly metallic lustre of graphite, it will be found that by repetition of the same experiments, the globules ultimately disappear, and the remaining solution in acid neutralized by ammonia, deposits only flaky silica, with traces of oxide of iron. On observing attentively the specimen of graphite, as found in its natural state, and comparing it with those treated with acids and alkalies, also exhibited, it appeared that the scales, before being operated on, had a dirty greyish appearance, described as owing to their being covered with spots, consisting of microscopic six-sided flattened prisms of silicate of iron; the matrix of this graphite formation, in the blast-furnace cinder, essentially composed of bisilicate of lime and alumina, deriving a yellowish tint from a slight admixture of sulphuret of calcium, with a trace of sulphuret of potassium. Scales of very different density may be separated, the thinnest unaffected by the magnet, the thicker ones decidedly so; those in the middle of the mass, thicker and stiffer, not easily broken, and showing a shining black fracture, like that of anthracite, form a variety of graphite, in which silicon and iron are greatly predominant, developing when treated with hydrochloric acid, a fetid hydrogen characteristic of cast iron, and separating at the same time yellow flocks of silica and alumina. Dr. Schafhaeutl then proceeded to point out an analogy between the formation of grey iron in the blast furnace, and that of graphite; namely, that the same chemical conditions occur during the change of white iron into grey; this takes place after having descended through the furnace, and reached the stratum of slag covering the melted metal; this slag being an earthy bisilicate (in coke furnaces, approaching to a trisilicate), and containing a small quantity of protoxide of iron. As silicon is found in graphite only in very small quantity, it has been considered an accidental impurity, just as the small quantity of hydrogen retained by charcoal, sulphur, &c. has been considered an impurity; but as these foreign matters can by no chemical means be separated, without destroying the state in which graphite, charcoal, and sulphur exist, it must be inferred that such admixture is essential to their existence in that state in which they ordinarily appear. Quitting now the individual consideration of graphite, the author extended the principle here argued to certain other substances, considered generally as simple bodies. For example, sulphur obtained by the decomposition of sulphurets by acids, is white in colour, and invariably combined with a stable quantity of hydrogen. But obtained from hyposulphites, it is as invariably yellow, and the presence of free hydrogen in the slightest quantity, bleaches the precipitate. The known case of sulphur precipitated under the presence of sulphuretted hydrogen, and cautiously mixed with metallic copper in its utmost state of minute division, being found to combine directly, evolving a dull red heat, has been considered an exception to the law, that no two dry bodies unite without the intervention of a third; but sulphur precipitated from hyposulphites, will not thus combine, nor will pure sulphur, though subjected to the minutest division possible. The same sulphur, however, brought into contact with hydrogen, under a pressure of four atmospheres, and then quickly mixed, is found to combine, as in the first instance, but if exposed to the air, its power of combination is again lost; thus, a third body is proved necessary here as in all cases. And further, the author doubted if one of the two different crystalline forms of sulphur is not owing to the presence of hydrogen, which he found to be in combination with it in a very perceptible quantity. These peculiar forms of combination where a few atoms of one body are combined with a high number of atoms of another, may be considered, perhaps, as forming a class of compounds intermediate between the inorganic and the higher organic compounds: thus, the compounds of arsenic acid form a very striking example. In the subarseniate of iron, 50 atoms of iron are combined with only 3 atoms of arsenic acid and 75 of hydrogen. So again, 24 atoms of arsenic with 1 atom of sulphuret of potash in sulph-arseniate of potash. By gradually passing from compounds of inorganic chemistry to those of organic chemistry, we find disacetate of copper with water, 48 atoms of oxide of copper combined with only 1 atom of hydrogen and 12 atoms of water. And finally in the field of organic chemistry itself, we have, for example, margaric acid, composed of 67 atoms of hydrogen, 35 carbon, and 3 of oxygen only. In the oleic acid, 120 atoms of hydrogen are combined with 70 of carbon and 5 of oxygen; in the stearic acid, 134 atoms of hydrogen with 70 of carbon and 5 of oxygen, &c. The author hinted in his paper in the *Philosophical Magazine*, that the principal circumstance which tended to produce compounds of such multiplicity of atoms, or, in fact, organic compounds, was the separation of the molecules of bodies brought into action by the capillary powers of the vessels of organic structures. It was probable that the chemical action of these separated molecules must be a different one from their action, when arranged into one definite form; and as proof that once received laws of affinity were exhibited only under peculiar circumstances, he directed the attention of the Section to H. Rose's compound, formed by direct combination of 29.97 per cent. of ammonia with 70.03 per cent. of sulphuric acid, which ought to have produced anhydrous sulphate of oxide; but after combination, neither sulphuric acid nor ammonium could be detected in the compound. The same chemist found combinations of anhydrous sulphuric acid with the chlorides of ammonium, potassium, sodium, and the nitrate of potash. According to the laws of affinity, for example, in the last case, the nitric acid ought to have been displaced, decomposed, and driven away by the more powerfully acting sulphuric acid; but no tendency whatever was shown to the displacement of chlorine or nitric acid, and new compounds, different from all hitherto known, resulted. As no combination of anhydrous sulphuric acid took place at all with oxide of calcium, chloride of barium, or chloride of copper, he concluded, that these above-mentioned combinations were formed only by replacing one double atom of hydrogen, water, or chlorine, in order to form a bisulphate of potash, soda, or ammonia. The author seemed to believe, that there existed two different states of chemical combination, the first in which the chemical forces of molecular attraction were acting only according to the relative quantities of matter; the second, where, under the always catalytic presence of a third, the elementary substances arranged themselves, separating in groups according to the resultant electric forces of the centres of action created by the above-mentioned presence of a third, acting differently on the different molecules of bodies in contact, in a somewhat similar way as a solution, which does not crystallize unless the molecular equilibrium of the liquid is disturbed. The first state of chemical combination might, perhaps, have some distant relation

to Dumas's law of types; the second state, a mere consequence of the first, would be represented by Berzelius's electro-chemical combination. The author, at the same time, referred to Prof. Graham's admirable papers, in which the Professor had so distinctly pointed out the great and *peculiar* part which matter performs in chemical solid combinations, and remarked, that during all chemical combinations where a third body is separated, the precipitation only would take place when a certain quantity of water combined with the body to be precipitated, which water separated in the relation to the separation and consolidation of the precipitate only, and could be driven away from it only by applying a red heat.

'New compound of Arsenious and Sulphuric Acids,' by Dr. Schafhaeutl.

This was obtained from the escaping smoke of copper calcining furnaces near Swansea, in South Wales. The new compound was another singular instance where an anhydrous crystallized body was deposited under the presence of water only, and was a remarkable proof of the unlimited number of different forms of combination, which might be produced even in inorganic nature, by bringing chemical substances in contact under varying circumstances. The copper ores smelted in South Wales were, for the greatest part, copper pyrites, mixed with iron pyrites, grey copper ore, &c.; in fact, a mixture in which the sulphurets of copper, iron, arsenic, antimony, cobalt, nickel, zinc, and tin, were invariably found together. The sulphur and arsenic escape from these ores during the calcining process, as sulphurous and arsenious acids, and have been found to destroy all vegetation for miles around the copper works, without affecting animal life in the slightest degree. By bringing the escaping fumes in contact with steam, and forcing it through burning charcoal, or subjecting it only to a great pressure in contact with steam, the new solid compound was deposited on the cool surfaces of the chambers connected with the calcining furnace. It was deposited in beautiful crystallized leaves or tables, perhaps belonging to the same class as Wöhler's dimorphic modification of the crystallization of arsenious acid, the regular form of which belongs to the octahedron. It was found to consist, in 100 parts,

of	68.250	Arsenious acid.
	27.643	Sulphuric acid.
	3.029	Protoxide of Iron.
	0.420	Oxide of Copper.
	0.656	Oxide of Nickel.
	99.998	
Corresponding to	51.741	Metallic Arsenic.
	11.095	Sulphur.
	2.339	Iron.
	0.336	Copper.
	0.516	Nickel.
	33.971	Oxygen.
	99.998	

These crystals attracted moisture from the air with great rapidity and with evolution of heat, corroding animal and vegetable substances as powerfully as concentrated sulphuric acid. Their taste was pure, but powerfully sour, similar to sulphuric acid, and, dissolved in water, the remainder of 100 parts of these crystals was 17.436 grains only. The shape of the crystals was perfectly retained, only their appearance was changed from transparent into opaque. Their chemical composition was found to be,

16.778	grains of Arsenious acid.
0.656	Oxide of Nickel.
17.434	

What the water had dissolved consisted of

51.472	Arsenious acid.
27.643	Sulphuric acid.
3.029	Protoxide of Iron.
0.420	Oxide of Copper.
82.564	grains.

One of the remarkable changes during the formation of this compound, was the conversion of sulphurous acid into sulphuric acid, as well as the presence of iron, copper, and nickel in a deposit from gaseous matter. No other definite compound of arsenic acid wi h another acid seems to be known, except those with the organic tartaric and paratartaric acids.

Section C.—GEOLOGY AND PHYSICAL GEOGRAPHY.

Presidents—Mr. C. Lyell; Mr. B. G. Greenough (*for Geography*).
Vice-Presidents—Rev. Prof. Buckland, Mr. H. T. De La Beche: Mr. J. Smith; Capt. Washington (*for Geography*).
Secretaries—Mr. W. J. Hamilton, Mr. H. E. Strickland, Mr. D. Milne, J. Scoular, M.D.; Mr. H. Murray (*for Geography*).
Committee—Prof. Agassiz, Sir J. E. Alexander, Messrs. R. Bald, J. E. Bowman, J. Bryce, Prof. Couper, Mr. T. Edington, Marquis of Enniskillen, Sir P. Egerton, Bart., Mr. R. Griffith, Lord Greenock, Mr. B. Ibbetson, Prof. Johnston. Messrs. W. Murray, R. I. Murchison, J. M'Adam, A. M'George, jun., Prof. Nichol, Marquis of Northampton, Mr. J. Phillips, Major Portlock, Prof. Ramsay, Dr. Rankine, Prof. Robb, Messrs. W. Sanders, G. W. Wood, M.P., J. Yates.

C. Lyell, Esq. F.R.S. in the chair.

The first communication brought before the meeting was from Dr. Robb, 'On the geology of the country round the river St. John, in New Brunswick.'—Dr. Robb stated, that the St. John is as large as any of the first class European rivers. It drains a large portion of the province of New Brunswick; and the volume of water which it discharges into the Bay of Fundy is very great, especially during the spring floods. Yet in one place the river is so contracted that it is not more than 310 feet in width. In the Bay of Fundy, as is well known, the tides rise higher than in almost any other part of the globe, there being sometimes, in spring tides, a rise of from 40 to 60 feet. The tidal wave is then forced up into the narrow parts of the river, and causes a backward fall of water, against the natural current of the water, of many feet in height. In the spring, the river is much swollen from the melting of the snow, and between its level in spring and in summer there is a difference of fourteen feet. Dr. Robb then alluded to the singular configuration of the country in the vicinity of the river, it being shaped in terraces, one below the other. The river, from the distance between the first or uppermost pair of terraces, appears to have been of much greater width, and subsequently to have gradually become contracted, until confined within its present narrow limits. The higher terraces slope towards the stream, the lower ones become more horizontal, and the lowest is with a slope turned from the river, an appearance which Dr. Robb explained by the successive depositions of alluvial matter near the bed of the stream, and extending no farther, so that depressions resulted behind these depositions, which often contain water. In no part of the world can the phenomena of rivers be studied better than in America, from the little alteration produced upon them by the hand of man. In many parts of the new continent the rivers present these terraces; they may be observed near the St. Lawrence, the Mississippi, and in many other places; and had the rivers of the Old World been examined before their banks became cultivated, in all probability they would, in many cases, have displayed similar terraces. Dr. Robb then adverted to the theory which explains the formation of these terraces by the bursting of the barriers of lakes through which the river had passed. He conceived that in a few cases the phenomena might be so explained, but that in general we must have recourse to an up-heaving of the land for the solution of the problem, and this up-heaving, he conceived, must have taken place at a comparatively recent period. In these terraces but few organic remains had been discovered, which he accounted for by the paucity of limestone rocks from which mollusca could obtain matter for the formation of shells; the long cold winter, too, might have its influences. He had, however, found in the lower terraces *Uniones* and *Anodontes* resembling those now existing in the river. Some bones had been discovered, but they seemed to be recent, probably belonging to the spermaceti whale. In the different terraces there was a difference in the quality of the soil, there being most alluvion on the lowest terraces. The middle terraces, being so nearly horizontal, were well fitted for roads, and advantage had been taken of them for that purpose. At Frederickton, where wells had been sunk, the vegetable soil was three inches deep, after which fourteen feet of sand was gone through, when water was obtained, retained by a bed of clay, underlaid by a slate rock. The terraces were composed wholly of detrital matter, the upper ones being coarser, and often having boulder stones, some of which were fifteen feet in diameter, and seemingly derived from parent rocks to the north-west, as they appeared to have travelled in a south-easterly course, indicated by scratches on the ground, coinciding with the major axes of the boulders. The rocks in the neighbourhood of the river are slates, with some limestone, the whole disturbed by syenite. In the Bay of Fundy, and also in the Gulf of St. Lawrence, are raised beaches, containing marine shells, which raised beaches he would place in the same category as the terraces of the river St. John.

Mr. Lyell alluded to a paper on Glen Roy, written by Mr. Darwin, in which he had had recourse to the theory of elevation, to explain the phenomena of the parallel roads. He had observed, in the district of Lochaber, terraces sloping towards a river, similar to those described by Dr. Robb, but the reflected lower terrace was peculiar to America, where, in inundations, the high alluvial banks next the bed of the river were the only land visible. He did not see any exact resemblance between the roads of Glen Roy and the terraces of the river St. John. It was remarkable, however, that in the latter there were both terraces of deposition, (viz. the lower,) and terraces of denudation (the upper).—Mr. Greenough was averse to the theory of elevation; he preferred that of a subsidence as causing the phenomena described, although the two theories might be reconciled. All rivers show indications of a greater rush of water than at present.—The Marquis of Northampton inquired respecting the nature of the vegetable soil on the surface of the terraces.—Dr. Robb explained, that the deposit differed both as to quantity and quality on the different terraces.—Dr. Buckland inquired whether there was any gravel or other detritus on the terraces?—Dr. Robb said the soil or sedimentary matter composing the lower terrace was of the finest quality, the materials being smaller than the others, where it was coarse. The farmers of the country were aware of this fact, and set three times the value upon the lowest which they did upon the higher terraces. In all cases in the lowest terrace there were found portions of the rocks occurring farther up the river.

Mr. Smith, of Jordan Hill, next read some extracts from a paper by Mr. Stevenson, 'On the Relative Level of Land and Sea, and on the alteration of the East Coast of England.' Mr. Stevenson had observed, in many places, but little variation in the mean level of high and low water, and he proposes this level as a standard or constant quantity. Certain stations in different parts of the kingdom are to be taken, and the point of medium level accurately ascertained in each of these, by the use of the spirit level and the tide gauge, throughout at least one lunation, embracing both the extremes, and the mean of the tidal range; these points to be marked by lines eighteen inches in length. The station to be taken at light-houses, in the north, south, west, and east of Great Britain and Ireland.

Mr. Smith then made some observations 'on the superficial beds in the neighbourhood of Glasgow,' the uppermost of which is a sand; the next a brick clay, interlaminated with sand, containing marine shells, and then a bed, called in Scotland till, and containing boulder stones. These are evidently post-tertiary. Between these and the sandstone are three other beds. Mr. Smith has discovered, in elevations, often forty feet above the present shores, beds of shells, containing about eighty-five per cent. of species now existing. Those of extinct species resemble shells from Canada, and indicate a colder climate at the time the animals existed. In the till, shells are of very rare occurrence, although it sometimes contains large bones. The bed of brick clay seems to have been frequently subjected both to elevation and subsidence; the latter condition being more difficult to observe, from its being often beyond our view. The brick clay of the neighbourhood of Glasgow appears also to coincide in age with the Carse clay of the east of Scotland, as may be seen in the valley of the Tay, where a singular phenomenon is presented by a bed containing stumps of trees, which is covered by another containing littoral shells. He mentioned that Dr. Thomson, of Glasgow, had recorded a whyn dyke that penetrated the superficial sand of that city, but he was not aware of the sand having been altered by it; also, that in Cumbrae a great wearing away of the sandstone was proved by the dykes, as they were now presented to the observer: allowing a foot in the century for this destruction, it would require many centuries to effect what has been done, which induced Mr. S. to consider the post-tertiary period to be much longer than is generally supposed.

Mr. De la Beche mentioned the occurrence of shells in cliffs, at a maximum height of forty feet in different parts of the west coast of Great Britain, a height coinciding with Mr. Smith's observations, and showing a general action.—Dr. Buckland mentioned some curious phenomena in the Mendip Hills, where the carboniferous limestone is found perforated by pholades, although far inland. He also stated his opinion, that the destruction of the sandstone at the Cumbrae might be more rapid than Mr. Smith imagined, from the immense destroying power exerted by storms. Recent observations had brought to light many curious phenomena of elevation and subsidence. At Swansea had been discovered submerged peat with footsteps of deer, and under this peat was a stratum with footmarks of deer also.—Mr. Milne observed, that in a cliff between Stirling and Falkirk shells occur at an elevation of forty feet, which elevation diminishes to thirteen feet lower down the Frith of Forth. On the east coast of Scotland, this bed of shells affords a proof of subsidence, from its being in one place overlaid by sea gravel. Near Stirling may be seen another cliff with a bed of shells, from ninety to one hundred feet in elevation, and which may be traced for three miles.—Mr. Keir announced the discovery of recent shells at Ardrossan, on the shore of the Frith, opposite Arran, thirty feet above the level of the sea.

The Secretary next read a paper by Captain Baddeley, 'On the Geology of Canada.'—The author regretted that little had been as yet done towards a mineral survey of this important colony, as it appears to possess sources of mineral wealth, highly deserving of attention. There is an abundance of iron ore, magnetic, and red and argillaceous oxide; also lead and copper. The part of Canada most metalliferous seems to coincide with a similar region in the state of New York; particularly the country behind Belleville, Kingston, Brockville, and Prescott, near the junction of the primary and secondary formations. Exact information on the subject is wanted, and it would be desirable that an accurate survey should be made of the country. It was mentioned, that some pieces of native gold had been discovered, but scarcely any indications of coal, although in the upper province, from the occurrence of saliferous strata, there was a greater likelihood of its being found: these strata occur near Toronto, and towards Lakes Erie and Huron.

Mr. Greenough spoke to the importance of an accurate geological survey of the United States boundary, as, in former treaties, our government had parted with valuable mineral tracts: he instanced the island of Banca, now so important for its tin mines.—Dr. Buckland mentioned, that large quantities of lime had been sent at a great expense to Gibraltar, the fortifications of which were built on a limestone rock.—Mr. Featherstonhaugh stated, that surveys had been made of Nova Scotia and New Brunswick, by direction of the local governments, and it rested with the Provincial Assembly of Canada to accomplish the same.

Mr. Bowman then read a paper 'On the Silurian Rocks of Llangollen, and on a Plateau of Igneous Rocks on the East flank of the Berwyn Range.' He showed, by the aid of two sections taken on the spot, and rendered more complete by data supplied by Colonel Colby, that the shales and slates composing the hills, for some miles north and south of Llangollen, and west nearly to Corwen, belong to the upper Silurian formation. The rocks have here lost the character of the mudstones of Shropshire and Montgomeryshire, and often resemble the Cambrian series; slates and flags, with perfect cleavage, being quarried at Glyn, Oirnant, &c. They rise from under the Upper Ludlow Rock of Castel Dinas Bran, in which Mr. B. found terebratula, navicula, cypricardia, &c., and they rest on the fossiliferous lower Silurian rocks of Cyrn y Brain. In some of the quarries were found orthocerata, graptolitheus ludensis, and cardiola interrupta. Unlike their soft and uniform equivalents, described by Mr. Murchison, they consist of three groups, passing into each other, and they are not separated from the Upper Ludlow by the usual Aymestry limestone. 1. Blue unfossiliferous shale rising conformably from under the upper Ludlow, and passing into parallel beds of hard siliceous schist, forming the bed of the Dee for several miles above Llangollen, and having their dip in the direction of the stream, and their projecting edges opposed to it. 2. A great thickness of uniform parallel beds of light blue shale, some of which on weathering are whitish, giving the section a banded or streaked character; they form the promontory of Rhysgog, and are largely developed on the west face of the Wridding, near the Holyhead road. Their lower portion is interstratified with bands of hard sonorous graywacke, and they pass into the next group. 3. Slates and flags, quarried at Cefn Uchaf, and on the chain of hills at Oirnant. At the north end of this chain, they repose on the lower Silurian rock of Cyrn y Brain. The total thickness of the three groups is about 3,100 feet. The plateau of igneous rocks occupies an area of about twenty square miles on the east flank of the Berwyn Mountains, between Llanarmon, Dyffryn Ceiriog, and Llansaintfraid Glyn Ceiriog, not noticed in the latest geological maps; it is divided by the river Ceiriog. They vary from a pure white compact feldspar to a grey or greenish trap, which in places is stratified and resembles graywacke. They throw off the sedimentary matter on all sides, bursting through it, and forming insulated trap hills. Near the centre, on the top of Pen y Graig, is a column of compact feldspar, twenty to twenty-five yards deep, and sixteen to eighteen yards wide, hemmed in on each side by lower Silurian rocks, which it has rifted asunder, and overspread laterally to some distance. Some of the stratified traps so repeatedly alternate with the schist, as to seem to be formed simultaneously; others seem to have been injected between the hardened beds. The rifted appearance of the trap in the gorges, shows a second up-heaving, after its first consolidation. Mr. Bowman had also examined the Bala limestone, and collected a number of fossils, which, with one exception, he found to resemble the lower Silurian rock. He is thus uncertain of the boundary between these and the Upper Cambrian. In addition to the absence of the dividing limestones of the upper Silurian, the old red sandstone is wanting in Montgomeryshire and Denbighshire, the carboniferous limestone resting on the upper or lower Silurian; to the north of Cyrn y Brain the limestone itself is wanting, and the millstone grit reposes on the fossiliferous lower Silurian rocks.

Section D.—ZOOLOGY AND BOTANY.

President—Sir W. J. Hooker.
Vice-Presidents—Rev. Prof. Fleming, D.D., Sir Wm. Jardine, Bart., Prof. Graham, Mr. P. J. Selby.
Secretaries—Prof. W. Couper, Messrs. R. Patterson, E. Forbes.
Committee—Prof. Agassiz, Dr. G. W. Arnott, J. H. Balfour, M.D., Mr. J. E. Bowman, Sir J. G. Dalyell, Messrs. G. T. Fox, J. Goodsir, — Gourlie, Dr. Klotzel, Prof. Link, E. Lankester, M.D., Messrs. W. F. Mackay, W. Macdonald, Dr. P. Neill, J. Scouler, M.D., Messrs. H. Strickland, J. Wilson, N. A. Vigors, M.P.

J. Fleming, D.D., in the chair.

Dr. Fleming, on taking the chair, expressed his regret at the absence of the President, Sir W. J. Hooker, who, on account of domestic affliction, could not attend the meeting.

The first communication was the Report of Prof. Henslow and Committee, 'On the Preservation of Animal and Vegetable Substances.'—The attention of the Committee has been directed to the preserving properties of certain materials when applied separately, either in saturated solutions, or in different degrees of concentration. The experiments have been conducted in glass jars 6 inches by 1½; and saturated solutions of the substances employed having been prepared, were diluted with an equal, and double, quantity of water. 178 preparations of animal and vegetable substances were tried. 1. Results obtained with animal substances. Three salts of potassa—the sub-carbonate, the bicarbonate, and the arseniate, have afforded the most satisfactory results. The solution of the bicarbonate afforded a flocculent precipitate: the solution half saturated appeared the best adapted. The substances preserving next best are, sulphate of zinc, muriate of magnesia, and arsenious acid. After these may be mentioned sulphate of magnesia, sulphate of potassa, and alumina (common alum), muriate of ammonia, sulphate of potash. Corrosive sublimate is a perfect preservative of animal substances; but this salt renders the substances so very hard, that singly it is unsuited to the purposes of natural history; added in small proportions to other solutions, which render objects too soft, it will probably be found of essential service, as well also in preventing the formation of flocculent matter. One part of naphtha to seven of water produces a favourable result, but when used stronger, the specimens are rendered tough. Acetic and oxalic acids decomposed the skin and cellular membrane of fish, but left the muscles untouched. A few drops of kreosote added to water, preserves the objects, but they become stained dark brown. The following substances are entirely unfit for preservatives: carbonate of ammonia, chloride of potash, muriate of barytes, muriate of lime, nitrate of ammonia, nitrate of strontian, the nitrates of barytes, soda, ammonia, and magnesia, phosphate of soda, the sulphates of soda, potash, iron, copper, and rough pyroligneous acid.—2. Results obtained with vegetable substances. The success here is very slight. None of the salts seem favourable, with the exception, perhaps, of the sub-carbonate and bicarbonate of potash. In naphtha and acetic acid, the specimens are preserved, but in the latter they lose their colour, and assume a reddish tinge. Prof. Henslow adds, in a note, that, although carbonate of soda of the shops is not mentioned in the report, he finds it to possess considerable preserving powers on animal substances.

Dr. Balfour observed, that he had seen fruits and other parts of vegetables preserved well in a solution of common salt in water. Arsenite of potassa also preserved the colour of flowers well. As a general rule, he believed that salts containing oxygen would not preserve animal substances.—The Rev. Mr. Brodie thought, that the discoloration of some plants might arise from the presence of tannin, or other principles, that acted on the substances in which they were preserved. He had observed oak and elm to become black in the same solutions in which fir and other wood became whiter than ordinary.—Dr. Fleming observed, it was passing from the dead to the living, but he saw there Sir John Dalyell, who was celebrated for preserving alive the lower forms of animals, and perhaps he would give them some account of his experiments.—Sir John Dalyell stated, that he had in his possession an actinia, which he had kept alive twelve years, another eight years, a holothuria two years, and other animals of the same class, of varying ages. He found it necessary to change their water every four or five days; when kept longer they became weak and incapable of sustaining themselves with their suckers. The actiniæ will live a long time without food. They feed on small fish, crustacea, and conchifera. The food of the holothuria he was not certain about. A young skait he kept would eat nothing but whiting.—Dr. G. Walker Arnott thought the preservation of plants had not been sufficiently attended to in the report. Spirits, he believed, a tolerably good preservative of plants. Sea-water spoiled delicate plants. The lower forms, as the fungi, &c., were most important, and nothing had been hitherto devised to preserve these in a good state. He had heard of their being kept by immersion in tallow, but had not tried it.

'Further Researches on the British Ciliograda,' by Edward Forbes and John Goodsir.—Since the last meeting of the British Association, the authors have continued their observations on these animals; no additional species have been discovered, but several interesting facts elucidating their structure have been brought to light. The species examined were the two forms of Cydippe designated *C. pileus* and *C. Flemingii*. They have repeated the observations of Mr. Garner on the ciliation of the walls of the stomach and vessels, and can bear testimony to their accuracy. The cilia towards the base of the stomach are larger than those on the oral portion. A row of very minute cilia surrounds the mouth, but none of these organs are seen on the filamentary tentacula, or on the walls of the filamentary cavities. The cilia which are placed on the longitudinal ridges are linear, lanceolate in form, flat, and not hollow. They are not webbed together, and have no communication with the vessels which run beneath the ciliary ridges. Each row of cilia is mounted on a transverse base of a more solid texture, and less transparent than the rest of the body. The substance of this base consists of globules irregularly imbedded in a homogeneous substance. A similar structure is seen to exist in the filaments of the Cydippe, and the bodies of the Hydroid zoophytes and of the simpler Nematoid worms are composed of a like substance. When one of the cilia of a Cydippe is cut off, it has, of itself, no power of motion, but if the

smallest portion of the substance of its base remain attached, it moves with great vivacity. Hence, the observers conclude that the ciliary motion is effected by undulatory movements of this peculiar tissue, which explanation will also account for the rotatory appearance of the circles of cilia on certain animalcules, and in a remarkable apparatus which they have discovered in the breathing sacs of the Echiurus, a vermigrade Echinodermatous animal, allied to the Sipunculus. They reject altogether the explanation of the ciliary motions given by Prof. Ehrenberg, Dr. Grant, and M. Raspail. From observations made on the circulating system of the Beroideæ, they are led to conclude, that the usual definition of that tribe as Acalephous animals, having two openings to their intestinal canal, the one anterior, and the other posterior, is incorrect. They believe the supposed anus to be imperforate, and a great portion of the supposed intestinal canal to belong to the circulating system. The tongue-shaped organ, which Mr. Forbes formerly described as existing in the stomachs of many of the Cydippes, has proved to be a remarkable parasitic Nematoid worm, fixing itself by means of four suckers or mouths to the walls of the stomach and of the vessels of the Cydippe, after interrupting the circulation of its fluids. For this strange parasite, Mr. Forbes has constituted a new genus, designating it *Tetrastoma Playfairii*, in honour of Major Playfair, of St. Andrews, who first drew attention to its parasitic nature. The authors summed up their paper by stating the results as, 1st, That ciliary motion was effected in the Ciliograda by means of a granular tissue, similar to that forming the bodies of the Hydroidæ and the lower Entozoa, on which the cilia are placed; 2ndly, That the Ciliograda are not Acalepha, having two openings to their digestive canal (as has hitherto been stated), but similar in structure to the other Medusæ; and, 3rdly, The discovery of parasites infesting the Acalepha.

Sir JOHN DALYELL had long suspected that the Beroes had but one aperture, and he was glad to find it confirmed. He wished to draw the attention of the Section to the production of Medusæ, which he had observed to take place in a very extraordinary manner from the stems of Virgularia, and also in the Hydra. The Medusæ thus generated were observed at three different times.—Mr. PATTERSON inquired of Mr. Forbes what powers he used, and what kind of light with the microscope. He was not prepared to hear all that was advanced in the Report, but in some points he was able to confirm it, especially in what related to the structure of the Beroideæ.—Mr. FORBES stated, that the power was not very high, and that polarized light was used when the granular tissue was discovered. He wished to add, that the tails of Cydippe, which are exceedingly moveable, are formed of the same tissue as that under the cilia in Beroe. He looked upon this tissue as the commencement of the muscular which was so fully developed in higher animals. He had observed a transition from this to muscular tissue in the *radiata*, in which the granules of this tissue were arranged in a linear form.

A paper was then read, entitled, 'Queries respecting the Human Race, to be addressed to Travellers and others, drawn up by a Committee of the British Association for the Advancement of Science, appointed in 1839.' At the meeting of the British Association held at Birmingham, Dr. Prichard read a paper 'On the Extinction of some Varieties of the Human Race.' He pointed out instances in which this extinction had already taken place to a great extent, and showed that many races now existing are likely, at no distant period, to be annihilated. He pointed out the irretrievable loss which science must sustain, if so large a portion of the human race, counting by tribes instead of individuals, is suffered to perish, before many interesting questions of a psychological, physiological, and philological character, as well as many historical facts in relation to them, have been investigated. Whence he argued that science, as well as humanity, is interested in the efforts which are made to rescue them, and to preserve from oblivion many important details connected with them. At the suggestion of the Natural Historical Section, to which Dr. Prichard's paper was read, the Association voted the sum of 5*l*., to be expended in printing a set of queries to be addressed to those who may travel or reside in parts of the globe inhabited by the threatened races. A Committee was likewise appointed by the same Section to prepare a list of such questions. The paper now presented, and to which the attention of travellers and others was earnestly invited, had, in consequence, been produced. The subjects embrace a wide field of inquiry, and the queries alone filled thirteen closely-printed octavo pages. They referred specially to the stature and weight of the people—any prevailing proportion between different parts of the body—the complexion—the colour and character of the hair and eyes—the formation of the head and face—the skull—and all physical peculiarities; the effect of intermarriage where it prevails—health, longevity, physical and intellectual character — language — ceremonies — superstition — education—dress—treatment of sick—nature of sickness—inferior animals associated with man—ceremonies connected with marriages, births, and burials—notions of a future state—habitations of the people—monuments—remains of skeletons—tools and instruments—form of government—food—mode of cooking—clans or castes—laws—geographical limits and character of the region—population—religious observances.

The Rev. J. BRODIE made some observations on the importance of attending to pronunciation in inquiries into the distinction of character between the various tribes of men. In many instances, where words were entirely forgotten, or the letters which spell them changed, they retained the same sound. In our own language, words had been adopted from the French, Latin, and Greek languages, but we had given them our own pronunciation. In many cases, particular sounds give a character to tribes, and might be illustrated by the difference between the pronunciation of the W in this country and in various parts of Germany. From the sounds, alone, he had been able to arrange all the languages of the world in three distinct classes. In an answer to inquiries which he had made on this subject through the *Athenæum* [see No. 667], his attention had been directed to the exertions of the American Society of Antiquaries, whose labours had thrown much light on the aboriginal inhabitants of the New World. Amongst these are two great classes, and, what is remarkable, they have a close affinity to some European tribes. For these reasons, he hoped the instructions to travellers would be more explicit on this particular point.—Dr. M'DONALD thought the theory of pronunciation as characterizing a people was carried too far, and the data to be obtained at the present day would not serve as an inference of the past. With regard to the adoption of words into the English language from the French, and their having acquired the sounds of the former language, it should be recollected, that many of the words supposed to be French are of an older date, and therefore have not recently changed their sound.—Mr. VIGORS thought the suggestion of Mr. Brodie important. The great aim of zoologists is to ascertain all the existing relations between man and other animals. This it was impossible to ascertain, unless we had an accurate knowledge of all mankind, for what is found in one tribe is not in another; and thus, without a knowledge of the whole, no true conclusion could be arrived at. This is the widest possible field of research, and includes an examination of all the mental and physical qualities of man. Amongst these inquiries, that relating to voice is peculiarly interesting, and no department would contribute more to elucidate the difficulties of the subject than an attention to this point.

Dr. LANKESTER gave an account of plants and animals found in the sulphureous springs of Askern and Harrowgate, Yorkshire.—The existence of organic matters or substances closely resembling them in their chemical nature, has been long known to writers on mineral waters, and under the names *Glairine*, *Zoogene*, *Baregine*, humo-extractive resin, animal and vegeto-animal matter, their existence has been recorded, and various properties ascribed to the mineral waters in which they are found. Of these, *glairine*, a substance found in thermal and cold sulphur springs, has excited most attention: many continental writers trace the origin of this substance to chemical changes. Dr. Daubeny, however, in a report on mineral waters, drawn up at the request of the British Association, has opposed this view, and is of opinion that its origin is organic. The existence of organic matter with a definite form, was first pointed out by Willan, and afterwards described by Dillwyn, as a plant under the name of *Conferva nivea*. This plant was found by the author in the sulphureous waters of Askern, in Yorkshire. In its early stages of growth, it corresponds with the organic fibres described by Dr. Daubeny, and in a more mature state with the plant as described by Dillwyn. It is of exceedingly rapid growth, and is found in waters impregnated with sulphuretted hydrogen, after being exposed to the atmosphere for a few hours. It rapidly decomposes, giving rise to secondary combinations which closely resemble the characters of *Glairine* as given by Prof. Anglada. In the waters of Harrowgate another species of conferva abounds, which in its structure resembles a species of *Oscillatoria*; it collects in large quantities around the sides of the wells, and, with deposits of inorganic and animal matters, forms layers of a dark green, white, and rose colour. In decomposing, these plants give out a more powerful odour than the water itself, a circumstance which has given rise to the opinion that a sulphuret of azote exists in these waters. These plants are peculiar to sulphureous waters, and probably have their existence determined by the sulphuretted hydrogen they contain. Throughout a large district in the neighbourhood of Askern, springs of water arise impregnated with sulphuretted hydrogen, and the soil around becomes saturated with it. In places where water runs over or collects on this soil, deposits are frequently seen varying from a light pink to a beautiful rose and carmine colour. These deposits rapidly appear and disappear, and have been found by the author to depend on the presence of two species of animalcules. One is oblong, with from two to ten stomachs, about the $\frac{1}{1000}$th of an inch long, and with rapid movements; the other is much longer, having about the same number of stomachs, and in its motions and shape very much resemble a *Vibrio*. The first resembles the *Astasia hæmatodes* of Ehrenberg, but it does not possess a tail, which is a characteristic of the genus *Astasia*. This animalcule was found, by Ehrenberg, forming a blood-coloured sediment in a lake on the Steppe of Platow in Siberia. These animalcules live in water artificially impregnated with sulphuretted hydrogen: they have never been seen in any place where sulphuretted hydrogen did not exist, and in many instances the author has been able to detect this gas by their presence, in places where he did not suspect its existence.

Dr. G. W. ARNOTT believed, from the drawings of the plants, that the first was the *Conferva nivea* of Dillwyn; the second, supposed by Dr. Lankester to be an oscillatoria, did not, he thought, belong to that genus. The existence of such plants was a curious phenomenon.—Mr. FORBES remarked, that the subject of organic life in mineral and thermal springs was of great interest, and one on which it would be very desirable that the British Association should call for a report.—The PRESIDENT had never before heard of the existence of animal life in so destructive a gas as sulphuretted hydrogen; and, had not the experiment been tried of keeping them in artificially-made sulphureous water, should have thought a slight impregnation of the gas might have taken place from the decomposition of animal substances in the ditches, &c. where the animalcules were found.—Dr. LANKESTER stated, that the smell of the waters in which the animalcules were exhibited would prove the existence of sulphuretted hydrogen. He had observed many other forms of plants and animalcules in these waters, and had brought forward the subject now, in the hope of gaining further information; he believed observations had been made by naturalists on this subject on the continent, but little was at present known respecting it in this country.

'On the Structure of Fishes,' by Dr. Macdonald.

The object of this communication was chiefly to correct the erroneous views of the analogy between the limbs of higher vertebrals and the fins of fishes,—errors entertained not merely by the more superficial compilers of the embellished picture-books and illustrations of Natural History,—but also by naturalists and anatomists of the highest rank. As this increased the danger, the author considered that it also increased the necessity of correcting the error. It was possible to point out, by means of the class of fishes alone, that the generally received analogies were erroneous. The pectoral fin has usually been

considered the analogue of the wing of a bird, and the ventral fin that of the leg. It was the object of the author to point out, from the anatomical structure of the pectoral fin, that it was really the analogue of the hind leg of the higher vertebrals. In order to admit the views of Cuvier and others, what will really be found to be the pelvis, femur and fibula, it is necessary to consider these three distinct bones as forming the scapula. In the haddock, cod, &c. there is a beautiful articulation or acetabular joint, which is never found in any scapula, even when it consists of more than one piece. The tibia is considered the clavicle, and the tarsus has to provide for the whole bones of the arm, fore-arm, and hand: thus while a prodigal waste of bone is bestowed on the scapulo-clavicular arch, the whole limb is supplied by the foot. An opposite system is found in the case of the ventral fins, where the whole pelvis and the two posterior extremities are represented by two bones supporting the rays of the fins. If, however, the pectoral fin be considered analogous to the pelvis and leg, the whole becomes changed; and it will be found that the supra-scapular bone is the os innominata with the acetabulum on its inner aspect—the scapula: the femur having its articulation turned and connected with the tibia on its surface; and thus what is the inside of the leg in mammals, is external in the fish; and what is in man the inner malleolus, is in fishes external, and so fully developed till it meets with the corresponding part of the opposite side, forming a firm arch under the respiratory region. The coracoid process will be easily recognized as the fibula, and the bones supporting the fin rays, instead of representing the whole arm, fore-arm, carpus, and fingers, will be the tarsus; characterized as it almost always is in mammals by having its bones arranged somewhat like the bones of the fore-arm and hand. This was demonstrated on the human skeleton. The ventral fins may be considered as merely the pubis. If the question were asked,—Where is the arm? the author referred to the opercular bones, which Geoffroy St. Hilaire mistook for the enlarged bones of the ear. The opercular bones being found in osseous fishes, and connected with branchial respiration, are also found in the *Proteus* of America, as may be seen by referring to the drawings of Humboldt; but as that animal has a pulmonic as well as a branchial respiratory system, we there find the more fully developed osseous arch of higher vertebrals. In the extensive class of fishes alone, we find the anterior extremity more fully developed, as in the cartilaginous rays, where the greatest part of the fish is composed of the hand, while the pelvis and legs are connected with the spine further down; and in the *Lophius piscatorius* (a specimen of which was exhibited), there will be found connected with the opercular bones a set of five rays; but as these do not protrude, but are merely imbedded in the substance of the skin, they have never been honoured by the gaze of systematizers of circular zoology. The use of the limb in the retroverted position, with the sole of the foot having an anterior aspect, will be principally applied to steadying the fish in its proper position, and backing out, the whole progression depending on the motion of the tail. The greater developement of the posterior than the anterior extremity, is not confined to fishes: in the tadpole it will be found first developed, and in the adult frog it is always much larger.

Section E.—MEDICAL SCIENCE.

President—J. Watson, M.D.
Vice-Presidents—Sir C. Bell, Dr. A. Buchanan, Dr. J. M'Farlane, Dr. Abercrombie.
Secretaries—Prof. Couper, Dr. J. Brown, Dr. G. O. Rees.
Committee—Drs. Alison, Arnott, R. Cowan, Hannay, J. Jeffray, J. Laurie, R. S. Sargent, A. Thomson, R. D. Thomson, Mr. J. Wickenden.

The Secretary read the Report of the London Committee 'On the Motions and Sounds of the Heart.' The detail of the experiments contained in the report rendered it so voluminous, that the Conclusions were separately drawn up, and alone submitted to the Section.

1st.—That the order of the motions of the auricles and ventricles, is by continuous succession, rather than by alternation.—2ndly. That the visible systolic and diastolic motions, are first perceived at the bases or fixed parts of the cavities, viz. in the auricles at the sinuses, and in the ventricles at the *Fundus cordis*, and that the free parts are brought into full action after the other parts.—3rdly. That in systole the heart is diminished in all directions, and that its long axis is invariably shortened.—4thly. That the normal systole of the auricles is energetic, and almost instantaneous, and quite universal.—5thly. That the systole of the ventricles is gradual in its developement, and complex in its phenomena, attributable to contraction of the muscular parietes, and to resistance on the part of the fluids.—6thly. That the pulsation of the veins is of two kinds, at least in some animals, viz. both active and passive, and the latter is attributable to reflux from the auricles during their systole.—7thly. *Motions.*—That the normal pulsation, or throb, appears to be caused mainly by the undulatory and eccentric resistance to muscular compression, exerted by the blood in systole, and to be in no degree attributable to any blow, stroke, or other form of impulse implying locomotion, or change of place, or any other change than that of shape and of parietal thickness and tension in the heart; this cardiac impulse is evident in the exposed heart.—8thly. That the arterial diastole, or pulse, almost everywhere outside the pericardium, perceptibly succeeds to the cardiac systole, though near the heart the interval is very brief.—9thly. *Sounds.*—That the first sound depends partly, but in a slight degree, on the abrupt closure and transitory tension of the auri-ventricular valves, which give to this sound its sharp well-defined beginning; but that the first sound is mainly attributable to cardiac muscular tension alone, and that its prolonged duration is probably owing to the progressive character of the normal systolic effort from fundus to apex, and that this sound is probably in no degree or condition attributable to any blow or stroke against the ribs.—10thly. That the auricular systole is attended by an intrinsic sound, resembling that of the ventricles, but more short, obtuse, and feeble.—11thly. That the sounds of friction in pericarditis, may when well marked, and under ordinary circumstances, be expected to be double at least, and they may be triple or more. In its systole, each cavity of the heart moves so as to cause a friction in one direction, of its attached laminæ, against the adjacent free laminæ of the pericardium, and in its diastole a pericardial friction is caused by each cavity in an opposite direction; and as the auricles move to and fro independently of the ventricles, the normal pericardial frictions must be quadruple, or double with the auricles and double with the ventricles. If, therefore, these frictions be rendered sonorous by the interposition of any rough substance between the rubbing surfaces, as lymph, for example, and supposing the heart's actions sufficiently vigorous, we might anticipate a duplication of murmurs at least, one systolic, the other diastolic. And this must be the principal element in the acoustic diagnosis of pericarditis.—12thly. The normal sounds of the heart are much liable to modification, by deviations from the normal standard, in the order, force, and excitability of the *carneæ columnæ*, and other contractile parts governing or influencing the action of the valves, and the closure or opening again of the orifices of the ventricles; and this dependence on conditions, excluding structural defect, is so considerable, that the second sound may be for a time variously modified or marked by strange murmurs, or even apparently suppressed, in consequence of changes in the solids of purely a dynamic character, or caused by humoral defect in consequence of hæmorrhage from the introduction of poison into the veins; and the first cardiac sound, though never wholly wanting during the active existence of the heart, may still under similar circumstances present various abnormal features.—13thly. That the peculiar sounds occurring in pericarditis, and attributed to pericardial frictions, are not referable only to vascular turgescence, or dryness of the pericardium, but to lymph effused by, and adhering to that membrane, or other equivalent obstacle to the easy and noiseless gliding over each other of the adjacent parts of the pericardium.—14thly. That the ventricles are of equal capacity during life, and that the inequality observable after death, is an illusion explained long since by Harvey.—15thly. That the suction influence upon the venous circulation, attributed to respiration, by various writers, is well founded.—16thly. That the action of the long muscles, and more especially those of the abdominal parietes, is attended with an intrinsic sound.—17thly. That the sounds of the heart, likewise the motions, are governed by the same law in all warm-blooded animals hitherto examined: that their causation likewise follows the same law as those of man, the first sound being mainly muscular, and the second probably exclusively valvular; likewise that there is the same causation and mutual relation of the cardiac and arterial pulsations.

Sir Charles Bell said, that it would be unfair to object to the conclusions, not having heard the premises on which they were founded; but, standing in sight of the Hunterian Museum, as he then was, he could not but remark on the absence of any reference to the opinion of so great a physiologist as Hunter, on the efficient cause of the cardiac impulse, when the apex of the heart strikes upon the parietes of the chest, viz. the effort made by the arch of the aorta to elongate itself upon receiving the column of blood, forced into it by the ventricular systole, by which effort the axis of the heart's direction is changed, the apex being forced up against the chest; and, in accounting for the sounds of that organ, there was no mention made of the rush of blood through those irregular masses the *carneæ columnæ*, and their tendinous connexions with the valvular apparatus.—Dr. Sargent stated, as a fact, proved by direct experiment, that if the heart be removed from an animal recently slain, and placed on the hand whilst still beating, the apex will continue to be elevated at each systole of the ventricles, which effect is manifestly produced without any connexion whatever with the arch of the aorta. He regretted that so long a period (five years) had elapsed between the publication of the Reports of the Dublin and London Committees on this subject, as it increased the difficulty of comparing the series of results together.

'On the Use of the Conglobate Glands,' by Dr. Jeffry.—After remarking on the inattention of physiologists to these bodies, and the uncertainty at present existing as to their uses in the animal economy, he mentioned the fact stated by Sir Everard Home, that the thoracic duct became in one instance ruptured, as he stated, from its own muscular action; this Dr. Jeffry denied to be the true explanation of the fact, as, if it were, the occurrence would be more frequent than it is found to be, and did not believe that there is any evidence of the muscularity of the coats of the absorbents; nor will capillary attraction account for the motion of the fluids in these tubes, as it will only act for a short distance, not more than five or six inches, and this too in tubes of minute calibre, much more minute than several of the absorbents were known to be. At the extremities he admitted the branches to be fine enough to act by capillary attraction, but to account for the motion of the fluids through the intermediate parts, he proposed the following causes:—First, the expanding power of the right ventricle of the heart, acting through the auricle on the thoracic duct; and, secondly, the elastic power of the conglobate glands, which draws the fluid forwards, the valves preventing a retrograde motion. He looked on these glands as little hearts, in fact, which by their expansion drew forward the fluid in the absorbents, as the greater heart did that of the veins by its expansive power; these views Dr. Jeffry said, he had promulgated in his lectures so far back as the year 1818.

Dr. Thomson observed, that the muscularity, or at least the contractility of the lymphatics, was, he understood, now established and acknowledged as a physiological fact; he had himself observed, on opening a horse immediately after death, the larger vessels to contract on the application of stimuli; but this contractility he did not deem a sufficient force to effect the circulation within them; he believed that a "*vis à tergo*" was generated by that power at their commencement, which has been called *vital imbibition*, but these forces might not be independent of the action of the absorbent glands indicated in Dr. Jeffry's communication. — Sir Charles Bell said, that these glands were not found in all classes of animals, and this might be urged as an objection to the views of Dr. Jeffry; but it would not be valid, as it frequently obtains in the animal economy, that new organs are required to carry out a greater complexity or perfection of organization. He then alluded to the fact, that the action of the absorbents was influenced by the action of the muscles of the neck, which was proved by direct experiment performed by Dr. Reid, who then detailed the experiment to the Section.

'On the Diffusion of Contagious Fevers, the Laws which govern them, and the Mode by which they are communicated,' by Dr. J. Perry.

From the prevalence of fever in Glasgow, it had been supposed to labour under some peculiar disadvantages of situation, or air, or want of cleanliness, which give rise to and favour the diffusion of typhus; but this he denied, and attributed the greater prevalence of fevers in Ireland and Scotland, than in England, to the greater poverty, mendicancy, and wandering habits of the population. The period observed by the disease in its epidemic returns, he stated to be from ten to fifteen years, during which time it exists in a sporadic form, and in its epidemic about two years. That destitution alone will not produce fever, he thought proved from the condition of the Highlands, for it was stated in the report of the Highland Relief Fund, that there were 150,000 persons in a state of absolute destitution, and yet he had it on the best authority, that fever was of rare occurrence amongst them, whilst they remained in their own residence; but that when they migrated to large cities, where the disease previously existed, they were immediately seized, and thus swelled the number of victims in the hospitals. Dr. Perry, in continuation, adverted to the laws by which the specific exanthematous diseases were governed, and from the carefully recorded results of many thousand cases, he attempted to prove the strict analogy of typhus fever to those diseases. From tables elaborately drawn up, many important deductions were drawn as to the effects of age, sex, season, &c. in modifying the susceptibility of and mortality from fever; from these results it appeared, that the number of females attacked by fever under twenty years, was greater than that of the males; that between twenty and forty they were equal, and from forty the male cases predominated. All ages were subject to typhus, unless protected by previously undergoing the disease; but the mortality under ten years is not more than two per cent., and that above forty-five it is nearly fifty per cent. The eruption characterizing the disease was described, and distinguished from those many appearances which accidentally occur in fever. The contagious diffusion was demonstrated, and numerous means of checking this diffusion pointed out, both by management of the sick, and a strict and judicious system of medical police, exercised amongst the unattacked, in those districts where it is known to prevail.

Section F.—STATISTICS.

President—Lord Sandon.
Vice-Presidents—Mr. Sheriff Alison, Rev. Dr. Chalmers, Lieut.-Col. Sykes.
Secretaries—Prof. Ramsay, Mr. R. W. Rawson, Mr. C. R. Baird.
Committee—Dr. Alison, Mr. J. Alston, Dr. Cleland, Mr. J. C. Colquhoun, M.P., Prof. R. Cowan, M.D., Messrs. W. Felkin, A. Fullarton, R. Griffith, W. Hall, J. Heywood, G. Kenrick, J. Houldsworth, J. Leadbetter, R. I. Murchison, Sir John M'Neil, Marquis of Northampton, Dr. Taylor, Messrs. R. Wallace, J. Wilson.

Col. Sykes in the chair.

Capt. Millar read a report 'On the State of Crime within Glasgow and City Police Jurisdiction, with Observations of a Remedial Nature.'

Population of Glasgow, within the Police Jurisdiction, supposed to be	175,000
Population beyond Police Jurisdiction, and within the Parliamentary boundary, supposed	97,000
	272,000

Extent of Crime.—During the year ending 31st of December 1839, the number of persons brought before the Magistrates of the city, including parties charged with contravening minor police regulations, as well as parties charged with crimes and offences, was 7,687, the males being in the proportion of three to one of the females. Of the total number, 468 were discharged, 5,410 summarily convicted, 661 sentenced to Bridewell, 46 sentenced to jail, 179 acquitted, 1,178 admonished, 72 ordered to find bail, 306 transferred to the Burgh Criminal Court, 72 to the Sheriff Court, 55 to the Justice of Peace Court, and 20 were sent to other counties. The estimated value of the property stolen within the police bounds, and reported at the office during the year 1839, including watches and money taken from the persons of individuals in a state of intoxication, was 7,653*l.* 10*s.*; the estimated value of property recovered 1,260*l.* 10*s.*; the number of attempts at housebreaking, discovered by the police, 84; the number of criminal informations lodged in the course of the year, 3,725; and the number of cases actually brought into court 5,047. As may be presumed, the aggregate number of offenders includes many parties who re-appeared. The preceding statement and relative table apply solely to the city of Glasgow Police jurisdiction, exclusive of the suburban districts; but it is right to state, that a very large number of the offenders within the city truly belonged to the suburbs. Nearly all the thefts of watches and money taken from the person, and those by domestic and other servants, were committed in circumstances beyond the control of the police, and where they could not act in a preventive capacity. Notwithstanding the increase in the population of the city and suburbs, the amount of crime has of late years diminished. This is satisfactorily shown by the diminution of the number of police cases of every description, with the amount of fines levied for petty assaults, disorderly conduct, &c. The number of persons sent to the Glasgow Bridewell from the Justice of Peace Court for offences of every kind, in the year 1836, was 224; in 1837, 412; in 1838, 401; in 1839, 498; and for the period ending 18th of August, 1840, 535. Of those offenders, during the two years ending 18th of August, 1840, 137 were sent to Bridewell for periods of from 5 to 60 days, for the non-payment of fines varying from 5*s.* to 5*l.* The number of persons sentenced to be executed in Glasgow, from the year 1820 to 1840, both inclusive, was 66, of whom 45 were hanged, and 21 had their sentences commuted to transportation for life. Of the persons executed, three were females. There have been only four executions in Glasgow since 1833; three for murder, and one for throwing vitriol with intent to murder.

Houses of Bad Fame.—The number of houses of this description within the royalty is 204, the greater part of which are of the lowest possible description. Of these houses 49 are kept by men, and 155 by women. The 49 houses kept by men are frequented by 346 females, and the 155 houses kept by women are frequented by 1,129 females. The total number of females ascertained by the police to frequent houses of bad fame within the Royalty, is 1,475.

Fires.—The number of fires in the city and suburbs, from 1st of January 1836 to 31st of January 1839, being three years, was 268. Of these, in 19 instances, the premises were totally destroyed; in 64 considerably damaged; and in 185 slightly damaged. In 232 instances the causes were ascertained, and were very varied; in 31, the causes were not ascertained; and in 5, the fires were considered wilful, the parties having been taken into custody, and the cases reported to Crown counsel. The most frequent cause was found to be from flues and stoves taking fire through carelessness.

Publicans.—In the year 1839, there were within the royalty of Glasgow 1,220, and within the suburbs 1,080 licensed public houses and other places for the sale of exciseable liquors—in all 2,300. These houses, particularly the low-rented class, are productive of evil to a fearful extent, and it was affirmed that three-fourths of the crime in the city originate in habits of drunkenness.

Pawnbrokers.—There are 33 licensed pawnbrokers, and about 400 small unlicensed brokers within the royalty. The small brokers carry on business to a great extent upon a system of the most vicious and ruinous nature, and for which no remedy has been provided. These small brokers present great facilities for the disposal of stolen property; and that the facilities thus offered form the strongest encouragement to the greater part of the thieves and vagrants who infest the city to steal and commit depredations. The pawnbrokers, it was submitted, ought to be licensed exclusively by the magistrates: the same careful selection of individuals should be made, as has been recommended in the case of publicans, and they should also be placed under special regulations: the police should at all times have the privilege of access, for inquiry or inspection; and the law should be rigidly enforced against all who have not a licence.

Health.—It is of great moment, as affecting the state of crime, that the health of the lower classes of the community be strictly attended to. In the very centre of the city, there is an accumulated mass of squalid wretchedness, which is probably unequalled in any other town in the British dominions. In the interior part of the square bounded on the east by Saltmarket, on the west by Stackwell-street, on the north by Trongate, and on the south by the river, and also in certain parts of the east side of High-street, including the Venals, Havannah, and Burnside, there is concentrated everything that is wretched, dissolute, loathsome, and pestilential. These places are filled by a population of many thousands of miserable creatures. The houses are unfit even for styes, and every apartment is filled with a promiscuous crowd of men, women, and children, all in the most revolting state of filth and squalor. In many of the houses there is scarcely any ventilation, dunghills lie in the vicinity of the dwellings, and from the extremely defective sewerage filth of every kind constantly accumulates. In these horrid dens the most abandoned characters of the city are collected, and from whence they nightly issue to disseminate disease, and to pour upon the town every species of crime and abomination.

The discussion on Capt. Millar's paper was chiefly confined to speculations on the causes of the increase or decrease of crime in particular years. Mr. Rutherglen expressed his regret that Capt. Millar had not obtained the statistics of police in the suburban districts of Glasgow, which he was assured would have been readily afforded. He mentioned that in the incorporated district of Corbal, the magistrates had established the right of surveillance and visitation over the lodging-houses, and had compelled those by whom they were kept to take licences, in which the number of lodgers each should receive was specified. He had himself, as dean of guild, fined those who took in more lodgers than they were allowed; and he averred on his own experience that much improvement, both in health and morals, had resulted from these regulations.

Mr. Leadbetter read a paper, by Dr. Cleland, 'On the Population, Trade, and Commerce of the City of Glasgow.'—As the principal facts have been communicated at former meetings of the Association (see *Athen.* No. 461), it will be sufficient on this occasion to give the following abstract:—

Increase of the Population, Revenue, &c. of Glasgow.

Population.—In 1801, the population, according to the Government census, was 83,769, and in 1840, according to the three subsequent decennial returns, including the nine years from 1831 to 1840, the population amounted to 271,656, showing an increase in 39 years of 187,887 souls—a rate of increase, it is believed, unprecedented in the country.

River Clyde.—In 1800, the revenue of the River Clyde was 3,319*l.* 16*s.* 6*d.* In 1839 it amounted to 43,287*l.* 16*s.* 10*d.*, being an increase during 39 years of 39,968*l.* 0*s.* 9*d.*

Shipping in Glasgow.—In 1651, a Committee of the Scotch Parliament appointed Commissioner Tucker to report on the revenue of the Excise and Customs in Scotland, who stated, that there were 12 vessels belonging to Glasgow—that the aggregate tonnage amounted to 957 tons. In 1840 the house of Messrs. Pollock, Gilmour, & Co., of this city, who are engaged chiefly in the North American timber trade, are owners of 21 ships, register 12,005 tons, navigated by 502 seamen. The house has eight different establishments that ship annually upwards of six millions cubic feet of timber, to cut and collect which, and to prepare it for shipment, requires upwards of fifteen thousand men, and six hundred horses and oxen in constant employment.

Steam Vessels.—On the 1st January, 1812, there was only one steam vessel in Europe, the Comet of Glasgow, of 30 tons burthen, with an engine of three horse power. Now almost every river teems with them. It appears from the Parliamentary Steam Vessel Inquiry, that on 11th February 1839, there were 766 steamers connected with the United Kingdom. Including the four North American mail steam packets, the steam tonnage of Glasgow, in 1840, may be estimated at 13,491 tons.

Custom House.—In 1812, the custom duties collected in Glasgow amounted to 3,124*l.* 2*s.* 4½*d.*; and in 1839 to 468,974*l.* 12*s.* 2*d.*, being an increase during 27 years of 465,850*l.* 9*s.* 11½*d.*

Post-Office.—In 1810, the revenue of the Glasgow Post-Office amounted to 27,598*l.* 6*s.*; and in 1839 to 47,527*l.* 7*s.* 7*d.*, being an increase during 29 years of 19,929*l.* 1*s.* 7*d.*

Supply of Water.—Prior to 1806, the city, comprehending the Ancient Royalty alone, was supplied by about 45 public and private wells. As some of these were frequently dry, and others contained water of a bad quality, it may be near the truth to take the average supply of each well at 120 gallons of useful water, thus making the aggregate supply 5400 gallons per day. The Glasgow and Cranstonhill Water Companies, now incorporated by Act of Parliament, produce, in 1840, 8,218,000 imperial gallons. The revenue of these two companies, for 1836, amounted to 25,302*l.* 13*s.* 9*d.*, and they laid out in conveying water from the Clyde to the city the sum of 349,808*l.*

The population in 1831, when the last census was taken, consisted of 163,600 Scotch, 35,544 Irish, 2,919 English, and 353 foreigners.

The following is a description of the householders:

Married men, 30,032; Widowers, 1,790; Bachelors, 1,437; Male Householders, 33,259; Widows, 6,824; Spinsters, 1,882; Female Householders, 8,706; Total Families, 41,965.

The births, including 471 still-born, being 6,868, and the population 202,426, there is one birth for every 29·47-100ths persons.

The marriages being 1,919, there is one marriage for 105·48-100ths persons.

The burials being 5,185, there is one burial for 39·4-100ths persons.

The number of families being 41,965, there are 4·82-100ths persons to each family.

The births being 6,868, and the number of marriages 1,919, there are 3·57-100ths births to each for every marriage.

Mr. Alston read a paper on the Glasgow Asylum for the Blind. His objects were to give a brief account of what has been done in printing in relief, in roman letters, for the use of the blind, being the system of reading which is in operation in the Glasgow Asylum (see *Athen.* No. 518), and which has been adopted in all the other institutions in this country, with the single exception of Liverpool; and secondly, to detail the mode of instruction, and give a short general account of the institution. By the system of printing in relief in roman letters, an easy method is opened of communicating information to the blind. The mode of instruction is this: After the pupils have acquired a knowledge of the shape of the letters of the alphabet, words of two or three letters are submitted to their touch. They are then made to feel the words with two or three of their fingers on adjoining letters, by which means they are able to decipher two or three letters at once, which, by practice, will give a dexterity and fluency to their reading. They are then taught orthography, and next proceed to study the derivation of words and their relation to each other. By this system of tuition, the sense of touch becomes the channel through which instruction is conveyed to the understanding and the memory. The branches of education taught in this institution are reading, English grammar, arithmetic, geography, and the elements of astronomy and geometry, music, &c. At present there are above twenty individuals, whose ages vary from ten to twenty-two years, who can read; and the attainments of some of them will bear a comparison with those of the same age and time under tuition who are in possession of every natural advantage. One of these is a young woman, who, after being educated in the Institution for the Deaf and Dumb here, lost her sight about seven years ago. She may now be seen daily receiving instruction from one of the more advanced blind children, tracing by the touch the form of the letters, which she still remembers, and then indicating them by spelling the words on the fingers to her blind companion. Afterwards she takes her slate and writes down the passage she has read. The restoration of this interesting individual to intercourse with the rational world, is a source of exquisite pleasure to herself, and of gratification to all connected with her.

The following table shows how the inmates were occupied during the year 1839:—

	Twine.	Baskets.	Mattresses.	Mats.	Rugs.	Weaving.	Knitting and Netting.	Spinning and Winding.	Total.
Men	11	9	1	1	1	13	..	..	36
Boys	6	2	..	..	..	3	8	..	19
Women	..	..	..	..	..	..	..	8	8
Girls	..	..	..	..	..	..	17	..	17
Porters	..	..	..	..	..	..	..	..	2
									82

Thus, the manufactory consists of seventy blind people, and twelve not blind,—viz. five men, six wheel boys, and one woman; the wages of the latter being chargeable on the different branches of the manufacture in which they are engaged.

Sales for the Year 1839.

	£	s.	d.
Twine	£610	10	9
Baskets	619	2	6
Mattresses	115	2	2
Baked Hair	85	8	5
Door Mats	155	8	5
Rugs	12	7	0
Knitting	163	4	7
Sacks for Grain	1,412	9	9
Hair Friction Mats	20	11	0
Nets for Walls	13	3	3
	£3,207	7	10
Expense of Superintendent, Matron, Teachers, &c. &c.	199	11	8
Wages	910	4	11
Premiums	54	8	10

The males are on piece-work, and are employed ten hours per day; but when any particular articles are wanted, they are permitted to work twelve hours. None of the females who are not attending classes work more than seven hours in summer and six in winter. Those attending classes work three hours each day, and none of them more than two hours at a time.

FRIDAY.

It having been announced, that Dr. Chalmers would on this day read a paper, 'On the Application of Statistics to Moral and Economic Science,' the Section room was filled long before the time appointed for the assembling of the members, and such a crowd collected before the door, that it was impossible for the chairman and committee to obtain an entrance. Under these circumstances the meeting was adjourned to the church adjoining the college, which in a few minutes was nearly filled. Lord Sandon took the chair, in what is usually called the precentor's desk, and Dr. Chalmers then partly read and partly delivered an address, which lasted two hours, replete with eloquence and ability, but which could hardly be regarded as statistical. He began by pointing out the value of statistics as a branch of inductive logic, enabling us to advance from special facts to general laws, and to combine in one comprehensive view the working of the moral and the physical rules, by which the condition of humanity is governed. There were men who could form such comprehensive views, others whose minds could not rise above petty details. The former were like men who could understand the workings and principles of Babbage's calculating machine, the latter similar to those who could only read off the figures when the process was completed; and there were numbers in the world who could do nothing more. Sound philosophy taught us how to distinguish the causal from the casual, and in some degree poured a spirit of prophecy on the mind: on the one hand it led us by analysis to trace back events and phenomena to their ultimate causation; on the other it taught us by synthesis to expect like and proportionate results from similar and analogous causes. Men who were incapable of understanding this process, denounced the results as mere theories. There was not a word more perverted or abused in our language than theory; but in the offensive sense in which it was used by these objectors, it was utterly inapplicable, for the predictions of sound philosophy had all the weight and force of conclusions, tested by actual experiment. The chemist and the mechanician predict, with certainty, the event of an experiment they have tried before; so also may the statist, for he too can possess invariable machines, and invariable materials. After-experience is indeed requisite to accredit his conclusion to mankind, but is not necessary to inspire confidence in his own mind, for that had already been acquired by antecedent experience. The difference between him and those who sneered at him as a theorist was, that he profited by experience which had been thrown away upon them, and instead of being a speculator, he was in fact the most faithful disciple of observation and experiment. As one instance of the confidence, which might be placed in the deduction of general inferences, from a thorough consideration of specific facts, he would take the difference between two systems of procedure, which might be designated the aggressive and the congregational. Let there be a proposal made for petitioning parliament on any subject, and one of two courses might be adopted, either the petition might remain for signature at some specified place, or it might be taken by active canvassers from house to house. The success in the one case would be tenfold greater than in the other. It was so in the case of obtaining subscriptions to a charity or purchasers for merchandise; there must be locomotion somewhere, either on the part of the enlister or the enlisted. Experience had decided in favour of the former, its success was accelerated by the force of moral suasion on the conscience, by the imitative tendency of men, by the impulse and communicating force of one energetic mind, exemplifying the action of individuals on masses. He could quote an instance which might be sneered at as professional, but which he trusted would be interesting to all who felt what is now universally recognized, if not with the heart, at least with the tongue,—the importance of national education, and of elevating the moral condition of the working classes. There was a small district near Edinburgh, consisting of a place called the Water of Leith, and two other hamlets, containing 1,350 inhabitants, who had been long and equally distinguished for their poverty and profligacy,—there were not so many as one in nine who attended any place of public worship. The remedy was either to build a church and leave the people to attend it, or not, as they pleased; or, having opened a place of worship, to go round from house to house, into the lanes and the by-ways, and "compel them to come in," by the compulsion of kindly entreaty and affectionate persuasion. The latter course was adopted; the people were not left to seek, but were sought. Those who adopted this plan counted beforehand on a prosperous result; they relied on the strength of a Christian minister to pioneer through a moral wilderness—on the experience of the good effect produced by the pious labours of sincerity in prisons and parishes,—on the susceptibilities of our common nature, which still maintained a lingering existence behind a front of sinning hardihood; on the feelings of survivors when the presence of a Christian pastor shed a halo of sympathy round the dying bed,—they did not calculate on speculations, but acted on experience. The event was present to their minds as a certainty before the fact made it manifest to all mankind. Let a faithful minister take upon him the charge of a limited number of persons in such a state of moral and spiritual destitution; let him be furnished with means to provide a remedy for ignorance, and the vice which results from ignorance; let him be able to give the scholarship of education and religion, and there could be no doubt, that in a few months he would witness a moral revolution. Nor would such successes be limited by special localities: religion and virtue thus brought within the doors and to the firesides, would obtain the same ascendancy in the filthy lanes and putrid closes of a crowded city, as amid the fragrant flowers and verdant foliage of the village. Human nature was the same in the dark cellars, as it was amid blooming landscapes, and a difference between the urban and the rural population in their moral capabilities, did not exist. The prevalent error on the subject, arose from our associating physical beauty of scenery, with moral loveliness in those by whom it was possessed. The 1,350 inhabitants of the Water of Leith, were as he had stated, of the very lowest rank in society: carriers, quarrymen, and pig-feeders; they were also immersed in the most filthy and degrading immorality. They wallowed in vice. For such people vainly would the heaven-directed spire rise, or the bell issue its summons; the sound would be a voice in the wilderness, wasting its sweetness on the desert air. But, by the introduction of the aggressive principle, an old malt-barn had been rendered not less efficacious than the splendour of a cathedral; and a bell, no way remarkable for melody or power, had obtained as ready obedience to its summons as the sweetest music that ever floated on air. An extra force was introduced, adequate to move and to impel. In the earliest stage, one had gone forth endowed with feelings of brotherhood who kindled the flame of sympathy in their bosoms; his week-day attention generated their Sabbath attention, and proved the aphorism that a house-going minister made a church-going people. The work of two generations was accomplished in as many months. The aggressive system in the malt-barn produced an average congregation of 364, while the attractive system in the neighbouring church only produced 5. Thus, these two forces in moral dynamics—the aggressive and the attractive—were to each other as 73 to 1. He wished that those who had shown hostility to the Statistical Section of the British Association, would consider the value of the single moral principle thus evolved. It was a new law in social science: it was at once an antiseptic, preserving moral health; and a restorative, curing moral degradation. Statistical facts were the *ipsa corpora* of science; the tables of the statists, like the formulæ of the analysts, embodied the past and guided to the future. He found it necessary to dwell on the importance of statistics, when confined to a limited field of observation. The tabulated returns of a small territory were far more valuable than wide and general views over a large field. A deeper insight into

the economics of society might be obtained from a single parish, household, or family, than from observations which must be superficial in proportion to their extension,—which must exchange solid strength for feeble splendour. These corpusculars of subjects were like the small specimens selected for experiment by the chemists, they were more manageable in the manipulation and more certain in the results. Those who, like Solomon's fool, had their eyes on all the ends of the earth, might succeed in giving a visionary outline, but accurate observations could alone form the foundation of science. It must not be supposed that the heart should be kept in abeyance. Any reference to the affections and emotions brought a leer of incredulity on the countenance of the utilitarians, who suppose that when man begins to feel he ceases to reason. Give them, however, their darling arithmetic; let them have the osteology of their figurate skeleton; they were a species of naturalists, whose love was entirely confined to dry specimens, and who had no regard for the living animal moving in life and beauty. They were like those members who used to quit the house of parliament when Burke was speaking, as if they believed that where there was brilliancy of expression there could be no substratum of argument. They dissevered the association which the ancient Greeks had established between the two great ideas of their philosophy, uniting in one word, *το καλον*, the notions of truth and beauty, showing that they recognized nothing to be true which was not beautiful, and nothing to be beautiful which was not true. He trusted that the disseverance of these notions would not be perpetuated, but that we should all unite with common affection to erect a common shrine for the common worship of moral loveliness and moral truth. The Water of Leith was not a solitary instance; he had mentioned, in conversation with Lord Lansdowne, instances where the aggressive principle had raised church attendance from 1 in 9 to 1 in 3. There are fifteen such examples round Glasgow, and one hundred and fifty throughout Scotland. He hoped that the results would be circulated through the world, and that we should have statistics of reform, as well as of crime, mortality, and pauperism. He then detailed at great length the results of the experiments he had made in Glasgow during 1816 and the succeeding years, but the account has been already published in his Moral and Civic Economy of Large Towns. He next referred to the efficacy of the aggressive system, as exhibited in the establishment of home-sewing schools. Six of these had been set up in a district containing nine thousand inhabitants, and had an attendance of about 30 each. The payment of the teachers was 5*l.* per annum, and 2*d.* per week from each pupil. Each of the pupils in turn took the charge of keeping the school clean and in order. The lesson of cleanliness and decency thus inculcated was carried to their own homes, and became the source of a great and almost a thorough reform. The lady patronesses, who attended these schools, placed their hearts in the work, and nothing could be more delightful to witness than the occasional recognitions between them and some of their pupils in the public streets. The perils of centralization, as contrasted with localization, were demonstrable from statistics. If we obtained the statistics of crime for several districts, separate and distinct, and found one of them signalized by the prevalence of one form of crime above all the rest, we must necessarily obtain some clue to the special circumstances in which that specific form of moral disease had originated. He suggested the propriety of such a comparison between Glasgow proper, and the districts included within the parliamentary limits of the borough, and instanced Calton as a spot in which there appeared to have been a diminution of drunkenness. He then entered into an examination of the system of centralization in the management of pauperism, and denounced the control of a central board and the whole system of unions. But as in this part of his address he merely repeated what he had previously published on the subject of pauperism, and as his reasoning was anything but statistical, we think it better to omit this discussion, which, indeed, was a little out of place. His general conclusion was, that "Divide et impera" was the great maxim to be applied in the questions of pauperism and of philanthropy. It was not for one man to attempt the entire regeneration and renovation of humanity; those who desired to ameliorate the condition of their fellows, should not waste their strength in generalities, but should exercise their energies in a definite sphere of action, proportioning its limits to their opportunities and their powers. It is enough for each to perform his own work within his own sphere. Others will follow him in another, or perhaps in the same field, and the aggregate of all, the generalization of the several results, should be left to Him whose agents we were in accomplishing the purposes of benevolence.

When Dr. Chalmers concluded, Dr. Cowan withdrew his paper until the Section should assemble in its regular meeting room.

Dr. Alison then read his 'Illustrations of the Practical Operation of the Scottish System of the Management of the Poor.'—He stated that it was not his intention to enter into the question of the religious obligation, humanity, or policy of systematic relief, but merely to illustrate the system established in Scotland. The Scottish law requires the heritors, ministers, and elders of parishes to levy a tax for the support of their poor; but the law is disobeyed or evaded, and the assessment varies from ½*d.* to 3*s.* 6*d.* per head in different parishes, the lowest sum being often levied in those districts where relief is most required. This irregularity arises from the tax-payers having nearly an uncontrolled power of assessing and distributing the poor-rates. There is also a prevalent belief that poor laws tend to increase the amount of pauperism, and deteriorate the character of the paupers. But it was plain that the *onus probandi* rested with those who did not obey the law; for those arguments would apply equally well to private charity, which must have the same tendency as that attributed to the legal provision. Now, many facts might be quoted to prove that the Scotch system had not had any beneficial effect in decreasing the numbers of the poor, but that on the contrary, the poor pressed upon the means of subsistence, and endured privations as painful to human life, as was the case in any country in Europe, where the relief of the poor had law in its favour. The amount of destitution in the rural districts is very various, but those which present the most favourable aspect are either in the vicinity of large towns or have a very small proportion of non-resident proprietors. It must not be supposed that those who come from the country to the towns intend to become paupers; they come to look for labour, but they came in greater numbers than were needed; many of them are feeble and disabled, and in spite of their privations they are unwilling to return home. The Scotch law of settlement, which requires only three years' residence, has no foundation in statute, but was sanctioned by the Court of Session so late as 1767, previous to which the support of indigent persons was thrown upon the place of their nativity. Were the old law revived, there were facts to prove that the amount of misery in Edinburgh would be greatly diminished. Of 871 out-pensioners of the city charity, only 259, or 1 in 3.36, are natives of Edinburgh, and of 432 inmates of that house, only 143 are natives; and of the out-pensioners 82 are Irish and 24 English. Similar disproportions, between natives and strangers receiving relief, were shown to exist in Dundee, Aberdeen, and several other towns. Out of 1,000 admissions into the Night Refuge, 487 only were natives of Edinburgh; 163 were Irish; 37 English; 9 foreigners, and the rest from various parts of Scotland. Of 346 persons applying for relief to the Benevolent and Strangers' Friend Society in July 1840, only 14 were natives of Edinburgh; 65 Scotch; 51 Irish, and 21 English, who had spent the prime of their life in that city; 89 Scotch, 77 Irish, and 29 English had not done so. Several other tables were quoted in proof that the larger proportion of the charitable relief given in Scottish towns is bestowed on strangers, and that a change in the law of settlement would relieve the towns from the pressure which they now feel. Evidence of redundant population, want of employment, and distress of the poor, was collected from the answers to queries issued by a society for inquiring into pauperism in Edinburgh. The number of persons who replied to these queries was 28; out of these, 26 declared that they had seen a vast amount of destitution during the last winter; 22 out of 25 declared that in numerous instances they had seen necessary articles of furniture and clothing sold to procure subsistence; 27 out of 28 described the food of the poor as scanty and precarious; 20 out of 26 ascribed much of this misery to intemperance, but some were inclined to believe that the intemperance might have been as much the result as the cause of misery; 23 out of 24 declared that many families of labourers are out of work several months in the year, and added that this was the case with artizans, single women, and widows with families, who were willing to work; 13 out of 15 described several instances in which numbers of individuals or families were associated in one room to diminish rent, and were thus exposed to influences pernicious to health and morals. To take one instance (said the doctor), where fifty might be given, there was a close in the Cowgate of Edinburgh where 48 families resided, consisting of 158 persons. Of this 48 there were 10 widows who did not earn, even when employed, more upon an average than 2*s.* 6*d.* a week; the larger portion of them had only occasional employment; few of them had permanent employment, and some of the men did not earn more than 3*s.* 6*d.* by their labours. Their furniture was scanty in the extreme; and 16 of them had neither furniture nor bedding at all: out of the whole number not more than 5 could be stated to be of intemperate habits. Of the very small number who received aid from the parish, the allowance did not amount to more than 5*d.* per week. A widow with only one child did not receive anything. Under these circumstances the poor were huddled together in great numbers in a single apartment; wretchedness banished every feeling of self-respect—step by step they sunk into the depths of wretchedness and demoralization. He dwelt at some length on the increasing neglect of the education of their children by the poor; and endeavoured to prove that disease, particularly fever, ought to be ascribed to destitution, rather than to the want of drainage, ventilation or cleanliness. He referred to the exhumations which had been made in Paris, and in Seville, to the prevalence of fever in localities which were comparatively high and clean, while those in apparently less favourable situations were free from disease; and to the reports published under the sanction of government, respecting the great fever in Ireland, to show that want of proper food was more commonly the source of contagious disorders than any other physical circumstance. Hence he concluded, that the drainage of the irrigated meadows, which bear the blame of the insalubrity of Edinburgh, will not effect all the good expected, but that a proper supply of food to the victims of want and misery would be more effective than any sanatory regulations of police. The Doctor concluded by stating the social results which he expected to follow from establishing a legal provision for the poor; dwelling chiefly on its effects in destroying the nests of pauperism which are established to a frightful extent in nearly all the towns of Scotland; each of which is a source of misery to the inhabitants, disease to the neighbourhood, and terror to the entire community.

SATURDAY.

Mr. Watt read a very elaborate paper, illustrated by a great variety of tables, 'On the comparative Vital Statistics of Edinburgh and Glasgow.'—It will be sufficient to indicate the most striking results, as the tables are too minute and professional for general readers. The proportion of resident marriages to the population in Edinburgh and Leith is as 1 to 144.449, or 0.692 per cent. In Glasgow, the proportion is as 1 to 124.942, or 0.800 per cent. In deaths there is a remarkable difference. The number of deaths under twenty years of age in Edinburgh in 1839 was 43.060 per cent. of the whole number of deaths; while in Glasgow the proportion was 62.312 per cent. In Edinburgh, the proportion of deaths to the population was as 1 to 45.435, or 2.200 per cent.; in Glasgow, the proportion was as 1 to 36.146, or more than 2.766 per cent. The deaths of children under five years of age are, in Edinburgh, 1 to 141.598 of the population; in Glasgow, they amount to 1 in 72.014: in Edinburgh they are less than one-third of the whole number of deaths, in Glasgow more than one-half. From the imperfect state in which the registers of births are kept in Scotland, Mr. Watt declared, that no reliance could be placed on the

existing data of comparison; and the same remark, though in a less degree, extends to the registration of the causes of death, as data for the statistics of disease.

Mr. Leatham read a paper 'On the Bill Circulation of Great Britain.'—He stated, that Bills had been left out of consideration in all discussions of the currency, and had been formally proscribed by the Committee of the House of Commons, which had not yet terminated its labours. He had, through Lord Morpeth, obtained a return of the number of stamps issued from 1835 to 1839 inclusive, and had based his calculations on the supposition that each bill was circulated for half the amount which the stamps would cover, which was considerably under the amount. From the experience of his own bank, compared with that of the principal discount offices in London, he had found, that the average date of bills, including foreign and inland, was three months. He then took the whole stamps for a year, and divided them by four, which gave the amount circulating at one time. By a similar induction, he had estimated foreign bills at one-sixth of the English, though the proportion was rather greater; and he had taken the same average for Irish bills in the years where no official returns had been made. He had taken every care to avoid exaggeration, and he was anxious that his data should be examined by the Section. He then exhibited the following statement relating to the bill circulation of Great Britain and Ireland, during the years under mentioned:—

	1815.	1824.	1825.	1826-7.
	£.	£.	£.	£.
Bill Stamps for Great Britain, creating the sum	477,493,100	232,429,800	260,379,400	207,347,400
Estimated Irish Bills	79,582,183	38,738,300	43,396,566	34,557,833
Foreign Bills	92,845,880	45,194,683	50,629,327	40,317,072
Total	649,921,163	316,362,783	354,405,293	282,222,305
Average amount in circulation at one time	162,480,290	79,090,695	88,601,323	70,555,576

The following is a similar return for the last five years:

	1835.	1836.	1837.	1838.	1839.
	£.	£.	£.	£.	£.
British Bills	294,775,269	355,288,900	333,268,600	341,947,400	394,203,000
Irish Bills	51,109,061	59,155,607	54,179,165	54,359,464	55,615,722
Estimated amount of Foreign Bills	57,914,721	69,420,406	65,012,080	66,500,577	75,479,120
Bills created by Bankers compounding for stamps	1,604,000	2,078,560	2,624,600	2,696,600	3,196,000
Total	405,403,051	485,943,473	455,084,445	465,504,041	528,493,842
Average amount in circulation at one time	101,350,762	121,485,868	113,771,111	116,376,010	132,123,460

The reading of these tables produced a very marked impression on the Section: most of the members declared that they were quite unprepared for such vast amounts.—Mr. Chadwicke pointed out a large amount of currency in circulation which Mr. Leatham had not adverted to—he meant money cheques; which there was a strong tendency at present to increase; indeed he believed that the clearance books of the banks would show sometimes transactions to the amount of three millions a day in cheques. He also referred to the dock warrants, of the amount of which it was difficult to form an idea. —Mr. Leatham said he had discovered a circulation of upwards of 528 millions in one year, and he would leave it to other gentlemen to discover more. (A laugh). He did not call cheques currency, as he looked upon them as merely orders for money, which were in existence generally only a few minutes, seldom more than a few hours.

Prof. Ramsay read a paper by Dr. Alston, 'On the Excess of Population, and on Emigration as a remedy for it in the Highlands of Scotland.' The author professed himself a disciple of Malthus, and convinced of the truth of the aphorism that population increases beyond the means of subsistence. In the Highlands, the effects are so palpable that they have forced themselves on attention, though means have not been taken to relieve the destitution. In the counties of Argyle, Inverness, and Ross, including Cromarty, the population in 1801 was 205,972, in 1831 it was 271,706, an increase of 32 per cent. It may safely be supposed, that the same rate will continue through the decennial period ending in 1841; this increase has taken place almost exclusively among the lower ranks, for every one acquainted with the Highlands knows that the race of tacksmen, or small farmers, has been greatly diminished. Taking the proportion of the population, dependent on labour for subsistence, at 65 per cent. in 1801, and allowing for the decline of the middle class, the proportion now is about 75 per cent., or about 200,000 individuals. Now, this increase in the number of labourers has not been accompanied by any increase in the amount of employment. The Highlanders are now kept alive, they cannot be said to be fed, on a diminished quantity and a deteriorated quality of nutriment. Potatoes, without anything in the shape of what is called *kitchen*, is the usual food; they are deemed fortunate if they can obtain salt, a little milk, or herrings in the season, or even raw onions. The rate of wages, however, has not fallen, but this is to be attributed to the natural indolence of the people preventing competition. No efforts have been made to overcome this indolence; the poor in the Highlands have been grossly neglected by the parochial clergy; the pastors neglected their flocks, and were so far from doing their duty in examining the qualifications of teachers, as they were bound to do by law, that for many years and in many places they neglected to have teachers appointed at all. In the Lowland counties, the ratio of increase was not half what it proved to be in the Highlands, notwithstanding the additional employment arising from improved systems of farming, and the establishment of manufactures. Having shown that there was a surplus population, the author discussed the means of creating a fund for promoting emigration; but as this discussion was economic rather than statistical, it need not be reported.

Mr. Robert Owen denied that there was a surplus population in the Highlands, or anywhere else, and at great length explained his views for remedying the evils of society, with which the public is already familiar.—Sir Francis Mackenzie denied that there was a surplus population in the Highlands; he possessed a district of them forty miles in length, and by personally exerting himself for his tenantry, taking an interest in their success, and labouring for their advancement, he had raised them not to the state of comfort which he hoped they might attain, but to a condition far in advance of their former wretchedness. He wished that persons interested in the subject would visit his estate, and judge by personal inspection. He would gladly afford every facility in his power for investigation.

Section G.—MECHANICAL SCIENCE.

President—Sir John Robison.
Vice-Presidents—His Grace the Duke of Argyle, Rev. Dr. Robinson (Armagh), Messrs. J. Taylor, J. Walker.
Secretaries—Messrs. J. S. Russell, C. Vignoles, J. Thomson, J. Tod.
Committee—Messrs. J. Dun, T. Edington, W. Fairbairn, J. Glynn, Prof. Gordon, Messrs. R. Griffiths, I. Hawkins, E. Hodgkinson, W. Jessop, A. Liddell, J. Macneill, R. Napier, Sir J. Rennie, Messrs. J. Roberts, J. Smith, C. W. Williams.

The first paper read was 'On Safety Valves for Steam Boilers,' by Mr. Galline.—The merit of the proposed alteration rested on the general principle, that the safety valves at present in use are not large enough; and Mr. Galline's object was to allow a large surface, like the lid of a chest, to rise when the pressure becomes sufficient to force it up; so that, on an accumulation of steam, it might escape, before any accident could take place. His proposal was, in brief, that a large valve shall open instead of a small one.

'On Extinguishing Fire in Steam Vessels,' by Mr. Wallace.—Mr. Wallace proposes to effect this by steam itself. The plan has been some time before the public, and many successful experiments made in the presence of scientific persons. Among the most important was the following, made on board the *Leven* steam-boat:—On the cabin floor, a space of ten feet by fourteen was covered with wet sand, on which was laid iron plates, and on these a fire was kindled with about 4½ cwt. of very combustible materials, such as tar barrels, &c. A hose thirty-four feet long, two and a half inches in diameter, extended from the boiler of the engine to the cabin, and when the fire had been sufficiently kindled, so that the panes of glass in the windows of the cabin began to crack by the heat, the steam was let in, and the doors of the cabin shut. The fire was extinguished in about four minutes. Several trials were made, and all with like success. On another trial, a metal pipe of a greater diameter than the hose was connected with the steam-boiler, and extended into the cabin. A small square hatch was cut in the deck immediately above the cabin, and through this opening were lowered down into the cabin two moveable grates, each containing a blazing fire, well kindled, of about 1 cwt. of coals. The hatch on the deck and cabin doors were then shut, and the steam let in, and in fifteen minutes the small hatch was opened, and one of the grates hoisted up, when the whole mass of coal and cinders, which had before formed a powerful fire, were found to be completely extinguished. This experiment was repeated twice with equal success.

In reply to a question from the President, Mr. Wallace said, that the hose might be made either of silk or canvas painted.—It was stated, that in Philadelphia, and now in London, the firemen always direct the water to the lowest part of the fire, that it might be converted into steam.—Dr. Hamel, of St. Petersburg, mentioned, that in Russia they have used woven hemp hose for fire-engines more than forty years.—Mr. Roberts, of Manchester, said, that in that town there had been a fire in a factory some time since, when the men went in, broke the steam-pipes, which were charged, shut the doors, and the fire was out immediately.

'On Wheels of Locomotive Engines,' by Mr. Grime.

The rim or felloe of the wheel is turned, welded, and blocked in the usual way to the size required, say three feet diameter; the side, or front rim of the wheel, is formed out of boiler plate-iron, say five-eighths of an inch thick, clipped round to size required. I then, said the writer, take the plates, and punch out the centre, which forms the eye of the wheel. After this, the shapes are punched out, leaving the boss and arms standing together, with a sufficient breadth of iron at the extremity of the arms that will be equal to thickness of felloe, say one inch and a half or two inches, for wear, and, when welded, forms part of the felloe. The boss of the wheel is punched out of plate-iron, say one-quarter of an inch thick, into what I denominate washers; I then pile them one upon another, to the breadth of the wheel, taking notice to cross the grain of iron every washer when piling them. By so doing, the boss, or nave, will be considerably stronger and tougher than if the grain of iron went all one way. When this is done, it bears the name of "faggotted iron." The washers being piled to the required thickness, I pin them to one of the punched plates, the diameter of wheel required; then put the rim or felloe on, and pin it to the plate. This being done, I put in the midfeather, say half an inch thick, and the depth of felloe and piled plates or boss, there being in every washer a half circle punched out to receive the midfeather; the other plate is then put on, and pinned to the other parts. The wheel being now formed, it is taken to the furnace, which is constructed with a revolving table at the bottom, so arranged that it can be dropped or raised. This table is formed of fire-brick, and on the top are placed five loose bricks, to keep the wheel from touching the table, and to enable the workmen to get the wheel into the furnace and out again by means of a fork. The furnace having been got up to an intense heat, the table is set to a particular mark, the door of the furnace is raised, and the wheel slided on to the table; the door is then closed, and the table, which is worked from underneath by a tooth and pinion, is turned round, presenting every part of the wheel regularly to the flame, as the flame rushes through the furnace. The wheel, having been in about three-quarters of an hour, and having arrived at a perfect welding

heat, the table is turned to the mark before mentioned, and the wheel is slided out on to an anvil. This anvil is planed perfectly true on the face, and is larger in diameter than the wheel. Above the anvil is the hammer, of about fifteen hundred weight, suspended at a height of about twelve feet, the face of this hammer being planed perfectly true, to correspond with the face of the anvil. As soon as the wheel is placed on the anvil, the hammer is released, falls on the wheel, and perfectly welds it into one entire solid at a single blow. Before pinning the wheel together, I put the various parts into a solution of vitriol and water, and, should there be any part corroded, it immediately removes it, so that there is nothing but pure iron, and a good welding is easily obtained. The wheel, when cold, is turned up in the usual way.

'On the Temperature of most effective condensation in Steam Vessels,' by J. Scott Russell.

Much (said Mr. Russell) has been said regarding the perfection of the vacuum formed in the condenser of a steam-engine, especially a marine engine. It does not appear to be known, that a vacuum may be TOO GOOD. We hear it boasted every day, by rival engineers, that their engines have the best vacuum. Some boast their vacuum at 27 inches, others at 28, others at 29, some at 30, and at last an engineer appears who boasts a vacuum of 30½ inches! It is to be regretted that time and talent should be thus wasted. It is a fact of great importance, and it is the result of theory, established on incontrovertible truth, and confirmed by experiment and by practice, that a vacuum may be too good, and become a loss instead of a gain. The truth is simply this, and should be known to every engineer: *If the barometer stand at 29½ inches, the standard of this country, the vacuum in the condenser is* TOO GOOD *if it raise in the barometer more than 28 inches of mercury.* This important truth is incontrovertible—it is practically exhibited every day. The following is a simple proof of this doctrine, divested as far as possible of a technical form, and put in the shape of an inquiry into the best state of a condenser:—

Let l = the caloric of water of 1°;
c = the constituent caloric of water in the state of steam;
e = the total force of steam in the boiler, in inches of mercury; and
x = the elastic force of steam at the temperature of best condensation, which we seek to discover.

Then from the law which connects the elastic force of steam with temperature, it follows, that in case of maximum effect, or the temperature of best condensation,—

$$\frac{l}{c}=\frac{x}{e}, \text{that is, } x=\frac{el}{c}$$

Now c is 1000; and if the steam in the boiler be at 5 lb. above the atmosphere, or if e=40 inches of mercury, and l=1,

$$x=\frac{40}{1000}=0.04$$

Again, if the steam be at 7½ lb. = 45 inches,

$$x=\frac{45}{1000}=0.045$$

Again, if the steam be at 10 lb. = 50 inches,

$$x=\frac{50}{1000}=0.05$$

Hence we find, that the best elasticity or temperature in the condenser depends on the elastic force of the steam in the boiler.

With steam of 5 lb. in the boiler, the elasticity of maximum effect in the condenser is 93° Fah., and the best vacuum on the barometer is 28.

With steam of 7½ lb. in the boiler, the elasticity of maximum effect in the condenser is 95°, and the best vacuum on the barometer is 27.8.

With steam of 10 lb. in the boiler, the elasticity of maximum effect in the condenser is 97°, and the best vacuum on the barometer is 27.6.

In like manner it would be found, that with steam of 50 lb. in the boiler, worked expansively, as in Cornwall, the best vacuum in the condenser would be about 26. on the barometer.

It is hoped, therefore, that engineers will not in future distress themselves at finding the vacuum of their condenser much less perfect than the vacuum of others who have obtained 30 and 30½ inches at so great loss of fuel and power. To obtain a vacuum of 29½, with the weather glass at 29.75, and steam at 7½ lb., would be to sacrifice four horses' power out of every hundred. In a day when the barometer is as low as 28¼ inches, the vacuum in the condenser would indicate 26.8. In speaking of the vacuum in the condenser, it would save much ambiguity to indicate the elasticity merely of the steam in the condenser; thus, if the barometer stand without at 29½, and the barometer of the condenser at 28, it might be stated that the steam in the condenser stands at 1½, being the point of maximum effort. The indication would convey at all times more precise information.

Mr. RUSSELL stated that the President had just put into his hands a communication in French on this subject from M. Barnes. Instead of a jet playing inside the condenser, M. Barnes allows it to rush in suddenly, and then stops it by a slide valve.—Mr. FAIRBAIRN wished to know whether the facts stated by Mr. Russell had been practically established.—Mr. Russell stated how the experiment might be made.—Mr. Fairbairn considered this a very important subject, as bearing on the economy of fuel, and regretted that Mr. Russell had not given an account of his experiments.—Mr. Russell suggested that Mr. Fairbairn should himself undertake the experiments.—Mr. HODGKINSON considered it very important that experiments should be carried on; and Mr. Fairbairn, that experiments should be made on steam at all pressures. It was suggested that this was a proper subject to be inquired into by the British Association, and it was agreed that the Committee of the Section should discuss the propriety of applying for a grant to pursue the experiments.—Mr. TAYLOR stated that they use plungers in the air-pumps in North Wales; and Mr. HARTOP, that in America air-pump buckets have been made without packing, and found to answer well.—Mr. ROBERTS stated that he had made engines with solid pistons without packing, both cylinder and air-pump.—Mr. VIGNOLES mentioned that such solid pistons had been used on some of the first locomotive engines on the Dublin and Kingstown Railway.

'On Warming and Ventilating Buildings,' by Mr. Ritchie.—The principal object of this paper was to call the attention of architects to the construction of houses, with a view to a better provision for heating and ventilation. The author described the method adopted by Sir J. Robison, whose house is warmed by a large supply of air heated to 70°, which is allowed to issue directly into the lobby and staircase, which it heats to 60° even in the coldest weather. This heated air is allowed to enter the sitting rooms freely by concealed apertures over the doors, and the vitiated air is carried off through openings in the ceilings by separate flues in each room.

Mr. HAWKINS always found that, in the sitting rooms, open fires were required to warm the feet, though not necessary in bed rooms.—Mr. HARTOP agreed, and considered Sylvester's Radiating Stove the best for the purpose, in addition to the general heating apparatus.—Mr. VIGNOLES concurred, and stated that nothing prevented Sylvester's stoves being universally introduced, but their high price.—Mr. Hawkins stated, that, from experience, a large fire with a small supply of air was the most economical mode of using fuel.—Sir JOHN ROBISON stated that, with the apparatus in his house, he can keep his staircase at a temperature of from 58° to 62°, when the current of heated air was only 64° as it issued from the apparatus, and that the additional expense caused by his provision for ventilation did not exceed 20*l*.

'On Timber Bridges of a large size, in special reference to Railways.'

Mr. VIGNOLES commenced his remarks by stating, that he had, by permission of the Committee, selected this subject for illustration and discussion before the Mechanical Section, from the notes of a work he was preparing for publication, 'On the General Principles and Economy of Railways,' his object in so doing being to elicit the opinions of his brother engineers, and to invite discussion and obtain information, but especially to direct the attention of all parties interested in the extension of the railway system to a principle of construction which, in many cases, would be found of great advantage in the economy and facility presented for overcoming obstacles, otherwise insurmountable, within reasonable limits of expense. Mr. Vignoles took a rapid view of the history of timber bridges, tracing their first erection in Germany, then through the United States of America, and back to Great Britain. He also described the difference between the principles of large bridges constructed with baulks and half-baulks, and of timber arches, formed of layers of plank laid over each other, and fastened securely together, and, with felt or other means, to make the joints and beds wholly impervious to water. Mr. Vignoles stated, that the first bridge on this principle in Great Britain had been erected at some place in Scotland, by an ingenious mechanic of that country, whose name he regretted not to be able to state. This was many years since. The principle had been also made known, particularly of late years, by the timber viaducts erected under the direction of Messrs. Green & Son, of Newcastle-on-Tyne, who had built several, and had designed more; and Mr. Vignoles further explained, that Mr. Nicholas Wood, of Killingworth, was at this time erecting, for the Duke of Buccleugh, a timber viaduct, of great height, and with large openings. Mr. Vignoles disclaimed any intention of discussing the question as to whom the merit of originality belonged, and observed, that he, at present, purposely refrained from any details, as these had been entered into by Mr. Green both at Newcastle and at Birmingham, reserving any remarks on such details for a future occasion, should it present itself. Mr. Vignoles then explained the peculiar applicability of timber bridges or viaducts to the passage of deep ravines, so often met with in hilly and mountainous districts, illustrating his remarks by diagrams. The communications, for example, to be made between the north of England and Scotland would probably have to be sought along some of the valleys leading to the passes through the Cumberland Hills, and here, as in many similar districts, engineers in the habit of considering such lines well knew, that many miles of favourable country for roads or railways were often to be obtained along the sides of such principal valleys, until some unavoidable and appalling obstacle appeared in the passage across some of the lateral openings or ravines. Instances had and might occur where the whole of such a line, otherwise highly desirable, would have to be abandoned, unless some economical construction were devised to surmount the difficulty: and here the timber viaduct would most advantageously be introduced, since many feet additional height in the level of the railway would add but little to the expense. He then instanced several places of formidable height, and of various breadths, where he had already designed, or knew of the applicability of such constructions. In reference to the expense, he stated, that it was chiefly when extraordinary height and either one arch of great span were required, or where a series of arches, of large openings, were wanted or could be introduced, that the timber viaducts were the most economical. In ordinary heights of 50 or 60 feet, and with arches of less span than 100 feet, and particularly in countries presenting facilities for construction of stone, these latter would be undoubtedly preferable; but when the height of the construction became great, the great expense for the centering for arches of masonry, and the multiplication of the number of piers, in order to keep the span of the arches to a moderate size, greatly increased the expense, and threw the balance vastly in favour of the timber. Mr. Vignoles instanced the Ribble Viaduct on the North Union Railway (a model and description of which is in the Model Room of the Association), which was about 50 feet high, with five large arches, of 120 feet span, and had cost 60*l*. per lineal foot; whereas, in another place, a timber viaduct, of 140 feet high in the centre, and averaging 100 feet high, with arches of 130 feet span, and extending for a length of nearly 2000 feet, was proposed, which would not exceed in price 20*l*. per lineal foot, the breadth of roadway being, in both cases, 28 feet for a double line of rails. Mr. Vignoles stated, that in extending lines of railway through the west of England to the packet stations, through the mountains of Wales for a communication between London and Dublin, and through many parts of Ireland, along the lines laid out by him for the Government Railway Commissioners, the timber viaducts would, from their cheapness, enable the works to be entered upon, which the great cost

of stone would quite forbid; and he concluded by calling on his fellow engineers to turn their attention to this while laying out new lines, and to take bolder steps across the valleys, relying on the timber viaducts to accomplish their objects.

Mr. Blyth thought that Mr. Vignoles had overestimated the expense of stone, which Mr. Blyth knew had been executed at about 25*l.* per foot.—Mr. Vignoles replied, that it was seldom that stone could be had at so small an expense; when the span is large, and the height great, it is much more costly.—Mr. Smith, of Deanston, agreed with Mr. Vignoles, but did not think that planking was the best method, as it would not stand so long. A wooden bridge should be so constructed, that any decayed part could be taken out and replaced.

GENERAL MEETING.—THURSDAY EVENING.

In consequence of the absence of the Rev. Vernon Harcourt, the President of the past year, the Marquis of Northampton took the chair. He lamented the unavoidable absence of Mr. Harcourt, who had taken so active a share in the formation of the Society, and had been one of its most zealous supporters. He congratulated the Association on assembling in a city equally remarkable for its extensive commerce and great manufacturing industry, and the seat of an ancient university, which had rendered eminent service to the united cause of literature, science, and humanity. Glasgow, the native town of Watt, had taken the lead in the practical application of steam as a moving power, and the animating display of steamers on the Clyde united the triumphs of art to the most romantic scenery of nature. He felt great pleasure in introducing their new President, the Marquis of Breadalbane; and, after a brief reference to the services which the Association had rendered to science, he resigned the chair.

The Marquis of Breadalbane, on taking the chair, stated his sense of the honour conferred on him, and observed, that it was unthought of, and unlooked for on his part; and he was afraid he had no claim to it, save that of one who had a firm conviction of the vast importance and value of science, and an earnest wish to support its best interests by every means in his power. It was unnecessary, he observed, in such a meeting, composed as it was of some of the greatest ornaments of our own country, and many of the highest character in science in foreign countries, to dilate on that bond of union which it presented for promoting the great object—the investigation of truth. The British Association had conferred great and valuable benefits upon the nation, and even the world at large. He adverted to the propriety of such a Meeting being held in Glasgow, a city combining in itself more perhaps than any other in the empire, the elements of national wealth—commerce and manufactures. He then called on Mr. Murchison to read—

The Address of the General Secretaries.

In entering upon the duty assigned to us, we heartily congratulate our associates on this our second assembly in Scotland. As, on our first visit, we were sustained by the intellectual force of the metropolis of this kingdom, so now, by visiting the chief mart of Scottish commerce, and an ancient seat of learning, we hope to double the numbers of our northern auxiliaries.

Supported by a fresh accession of the property and intelligence of this land, we are now led on by a noble Marquis, who, disdaining not the fields we try to win, may be cited as the first Highland chieftain who, proclaiming that knowledge is power, is proud to place himself at the head of the clans of science.

If such be our chief, what is our chosen ground? Raised through the industry and genius of her sons, to a pinnacle of commercial grandeur, well can this city estimate her obligations to science! Happily as she is placed, and surrounded as she is by earth's fairest gifts, she feels how much her progress depends upon an acquaintance with the true structure of the rich deposits which form her subsoil; and, great as they are, she clearly sees that her manufactures may at a moment take a new flight by new mechanical discoveries. For she it is, you all know, who nurtured the man whose genius has changed the tide of human interests, by calling into active energy a power which (as wielded by him), in abridging time and space, has doubled the value of human life, and has established for his memory a lasting claim on the gratitude of the civilized world. The names of Watt and Glasgow are united in imperishable records!

In such a city then, surrounded by such recollections, encouraged by an illustrious and time-honoured University, and fostered by the ancient leaders of the people, may we not augur that this Meeting of the British Association shall rival the most useful of our previous assemblies, and exhibit undoubted proofs of the increasing prosperity of the British Association?

Not attempting an analysis of the general advance of science in the year that has passed since our meeting at Birmingham, we shall restrict ourselves, on the present occasion, to a brief review of what the British Association has directly effected in that interval of time, as recorded in the last published volume of our Transactions. From this straight path of our duty we shall only deviate in offering a few general remarks on subjects intimately connected with the well being and dignity of our Institution.

One of the most important—perhaps the most important service to science—which it is the peculiar duty of the Association to confer, is that which arises from its relation to the Government,—the right which it claims to make known the wants of science, and to demand for them that aid which it is beyond the power of any scientific body to bestow. In the fulfilment of this important and responsible duty, the Association has continued to act upon the principle already laid down in the Address of the General Secretaries at the Meeting at Newcastle in 1838, namely, to seek the aid of Government in no case of doubtful or minor importance; and to seek it only when the resources of individuals, or of individual bodies, shall have proved unequal to the demand. The caution which it has observed in this respect has been eminently displayed in the part which it has taken with reference to the Antarctic expedition, and to the fixed Magnetical Observatories. It abstained from recommending the former to the Government until it had called for and obtained from Major Sabine, by whom the importance of such an expedition was first urged, a report in which that importance was placed beyond all doubt; and it withheld from urging the latter, although its necessity was fully felt by some of its own members, until the letter of Baron Humboldt to the Duke of Sussex gave authority and force to its recommendation.

The delay which has in consequence occurred, has been productive of signal benefit to each branch of this great twofold undertaking. Since the time alluded to, our view of the objects of investigation in Terrestrial Magnetism have been greatly enlarged, at the same time that they have become more distinct. Major Sabine's memoir on the Intensity of Terrestrial Magnetism, has served to point out the most interesting portion of the surface of the globe as respects the distribution of the magnetic force, and has indicated, in the clearest manner, what still remained for observation to perform: and the beautiful theory of M. Gauss, which has been partly built upon the data afforded by the same memoir, while it has assigned the most probable configuration of the magnetic lines of declination, inclination, and intensity, has done the same service with respect to all the three elements.

In another point of view, also, delay has proved of great value to both branches of the undertaking, but more especially to the fixed observatories. Our means of instrumental research have, since the time of their first projection, received great improvements, as well in their adequacy to the objects of inquiry, as in their precision; and finally, the two great lines of inquiry—the research of the distribution of Terrestrial Magnetism on the earth's surface, and the investigation of its variations, secular, periodic, and irregular,—have been permitted to proceed *pari passu*.

Last of all, the prudent caution, and vigilant care, which the two great scientific bodies have exhibited, both in the origin and progress of the undertaking, have naturally inspired the Government with confidence; and while on the one hand Science has not hesitated to demand of the country all that was requisite to give completeness to a great design, so on the other, the Government of the country has not hesitated to yield, with a liberal and unsparing hand, every request the importance of which was so well guaranteed.

But while we thus enumerate the benefits which have resulted to magnetical science from the delay, it must be also acknowledged that something has been lost also, not to science, but to British glory. Although terrestrial magnetism stood forward as the prominent object of the Antarctic expedition, yet it was also destined to advance our knowledge of the "*physique du globe*" in all its branches, and especially in that of geography. Had the project of an Antarctic expedition been acceded to when it was first proposed, viz., at the meeting of the British Association in Dublin, in 1835, there can be no reasonable doubt, that a discovery, which, by its extent, may almost be designated a Southern Continent, situated in the very region to which its efforts were to have been chiefly directed, must have fallen to its lot; and the flag of England been once more the first to wave over an unknown land. But while, as Britons, we mourn over the loss of a prize which it well became Britain and British seamen to have made their own, it is our part too as Britons, as well as men of science, to hail the great discovery—one of the very few great geographical discoveries which remained unmade;—and to congratulate those by whom it has been achieved, those whom we are proud to acknowledge as fellow labourers, and who have proved themselves in this instance our successful rivals in an honourable and generous emulation.

The caution which has characterized the British Association in the origination of this great undertaking, has been followed up by the Royal Society in the manner in which it has planned the details, and in the vigilant care with which it has watched over the execution. Of the success which has attended this portion of the work, the strongest proof has been already given in the unhesitating adoption of the same scheme of observation by many of the continental observers, and in the wide extension which it has already received in other quarters of the globe. All that yet remains is to provide for the speedy publication of the results. The enormous mass of observations which will be gathered in, in the course of three years, by the Observatories established under British auspices, and by the Antarctic expedition, will render this part of the task one of great expense and labour. To meet the former, we must again look to the Government, and to the East India Company, who will certainly not fail to present the result of their munificence to the world in an accessible form. The latter can only be overcome by a well organized system. The planning of this system will, of course, be one of the first duties of the Royal Society; and it is important that it should be so arranged, that while every facility in the way of reduction may be given to those who shall hereafter engage in the theoretical discussion of the observations, care is taken at the same time that the data are presented entire, without mutilation or abridgment. The Council of the Royal Society will, doubtless, be greatly assisted in this duty by the eminent individual who has had in every way so large a share in the formation of these widely scattered magnetic establishments, and whose own Observatory, founded by the munificence of the Dublin University, has nearly completed twelve months' magnetic observations on that enlarged and complete system of which it set the first example.

In referring, as we have done, to those most valuable services which the Royal Society have rendered, and are continuing to render, in directing and superintending the details of this great undertaking in both its branches, it is right that, on the part of the British Association, we should express the cordial satisfaction and delight with which we witness their exertions, united with our own in this common cause; nor should we omit to recognize how much this desirable concurrence has been promoted by the influence of the noble President of the Royal Society, the Marquis of Northampton, whom, as on so many former occasions, we have the pleasure of seeing amongst us, as one of our warmest supporters and most active members.

In the volume of our Transactions now under notice, is contained the memorial presented to Lord Melbourne by the Committee of the British Association, appointed to represent to her Majesty's Government the recommendation of the Association on

the subject of terrestrial magnetism. This memorial is one of many services which have been rendered to our cause, by Sir John Herschel, whose name, whose influence, and whose exertions, since our meeting two years since at Newcastle, have largely contributed to place the subject where it now stands. The devoted labour of other of our members has long been given to an object which they have had deeply at heart, viz. the advancement of the science of terrestrial magnetism; but the sacrifice which Sir John Herschel has made of time, diverted from the great work in which his ardent love of astronomy, his own personal fame, and his father's memory, are all deeply concerned, the more urgently demands from our justice a grateful mention,—because the science of magnetism had no claim on him, beyond the interest felt in every branch of science, by one to whom no part of its wide field is strange, and the regard which a national undertaking such as this deserved, from the person who occupies his distinguished station amongst the leaders of British science.

The advancement of human knowledge, which may be reckoned upon as the certain consequence of the Antarctic expedition (should Providence crown it with success), and of the arrangements connected with it, is of so extensive a nature, and of such incalculable importance, that no juster title to real and lasting glory than it may be expected to confer, has been earned by any country, at any period of time; nothing has ever been attempted by England more worthy of the place which she occupies in the scale of nations. When much which now appears of magnitude in the eyes of politicians has passed into insignificance, the fruits of this undertaking will distinguish the era which gave it birth, and, engraved on the durable records of science, will for ever reflect honour on the scientific bodies which planned and promoted it, and on the Government, which, with so much liberality, has carried it into effect.

Were the value of this Association, Gentlemen, to be measured only by the part which it has taken in suggesting and urging this one object, there might here be enough to satisfy the doubts of those who question its utility: to overlook such acts as these, and the power of public usefulness which they indicate, to scrutinize with microscopic view the minute defects incidental to every numerous assemblage of men, to watch with critical fastidiousness the taste of every word which might be uttered by individuals amongst us, instead of casting a master's eye over the work which has been done, and is doing, at our meetings, is no mark of superior discernment and comprehensive wisdom, but is evidence rather of confinement to narrow views, and an indulgence of vain and ignoble passions.

But to proceed with our useful efforts. One of the principal objects of our Annual Volumes is the publication in the most authentic form of the results of special researches, undertaken by the request, and prosecuted in many instances at the cost, of the Association. It is a trite remark, that if a man of talent has but fair play, he will soon secure to himself his due place in public estimation. We fully admit the truth of this in many instances, and above all where the points of research are connected with commerce and the useful arts; but many also are the subtile threads of knowledge, which, destined at some future day to be woven into the great web in which all the sciences are knit together, are yet not appreciable to the vulgar eye, and, if simply submitted to public judgment, would too often meet with silent neglect. Numberless, we say, are the subjects (and if your Association exceeds a centenary, still more numerous will they be) with which the retired and skilful man may wish to grapple, and still be deterred by his want of opportunity or of means. Then is it that, adopting the well-balanced recommendations of the men in whose capacity and rectitude you confide, you step forward with your aid, and bring about these recondite researches, the result of which in the volume under our notice we now proceed to consider.

The first of these inquiries to which we advert, you called for at the hands of Prof. Owen, upon 'British Fossil Reptiles,' one of the branches of Natural History, on a correct knowledge of which the developement of Geology is intimately dependent.

The merits of the author selected for this inquiry are now widely recognized, and he has, with justice, been approved as the worthy successor of John Hunter, that illustrious Scotchman who laid the foundation of comparative anatomy in the British isles. That this science is now taking a fresh spring, would, we are persuaded, be the opinion of Cuvier himself, could that eminent man view the progress which our young countryman is making towards the completion of the temple of which the French naturalist was the great architect. It is therefore a pleasing reflection, that when we solicited Prof. Owen to work out this subject, we did not follow in the wake of Europe's praise, but led the way (as this Association ought always to do), in drawing forth the man of genius and of worth; and the value of our choice has been since stamped by the approval of the French Institute.

If Englishmen* first perceived something of the natural affinities of Palæosaurians, it was reserved for Cuvier to complete all such preliminary labour. The publication of his splendid chapters on the Osteology of the crocodile and other reptiles, drew new attention and more intelligent scrutiny to these remains; and it ought to be a subject of honest pride to us to reflect that the most interesting fruits of the researches of that great anatomist were early gathered by the English palæontologists, Clift and Home. One of our leaders, whose report on Geology ornaments the volumes of this Association, formed the genus *Plesiosaurus*, on an enlarged view of the relation subsisting between the ancient and modern forms of reptile life; while shortly after Buckland established the genus *Megalosaurus*, and Mantell, *Iguanodon* and *Hylæosaurus*, worthy rivals of the *Geo Sauri* and *Moso Sauri* of Cuvier. The other Englishmen who have best toiled in the field, are De la Beche, Hawkins, and Sir Philip Egerton.

Yet although this report is on *British* reptiles, we are fully alive to the great progress which this department has made, and is making, on the Continent, through the labours of Count Münster, Jäger, and Hermann Von Meyer. The last-mentioned naturalist has been for some time preparing a series of exquisite drawings of very many forms unknown to us in England, most of which have been detected in the Muschelkalk, a formation not hitherto discovered in the British isles. Yet despite of all that had been accomplished in our own country or elsewhere, Prof. Owen has thrown a new light of classification on this subject, founded on many newly-discovered peculiarities of osseous structure, and has vastly augmented our acquaintance with new forms, by describing sixteen species of *Plesiosauri*, three of which only had been recognizably described by other writers; and ten species of *Ichthyosauri*, five of which are new to science. Such results were not to be obtained without much labour; and previous to drawing up his report, Prof. Owen had visited the principal depositaries of *Enaliosauri* described by foreign writers, as well as most of the public and private collections of Britain. This, the first part of Mr. Owen's report, concludes with a general review of the geological relations and extent of the strata through which he has traced the remains of British Enaliosauri. The materials which he has collected for the second and concluding portion of his report, on the terrestrial and crocodilean sauria, the Chelonia, Ophidian, and Batrachian reptiles, are equally numerous, and the results of these researches will be laid before the Association at our next meeting. Deeply impressed as we are with the value of this report, we cannot conclude a notice of it without again alluding to its origin, in the words of Prof. Owen himself: "I could not," says he, "have ventured to have proposed to myself the British Fossil Reptilia as a subject of continuous and systematic research, without the aid and encouragement which the British Association has liberally granted to me for that purpose."

Mr. Edward Forbes, whose labours in detecting the difference of species and varieties among the existing marine testacea of our shores have been most praiseworthy, has on this occasion given us a report 'On the Pulmoniferous Mollusca of the British isles.' The variations in the distribution of the species in this class of animals, are shown by him to depend both upon climate and upon soil, the structure of the country (or geological conditions) having quite as much share in such varied distribution, as the greatest diversity of temperature. The Association has to thank the author for valuable tables, which show both the distribution of the pulmoniferous mollusca in our islands, and their relations to those of Europe generally.

From Zoological researches, let us now turn to Physical Geology. One of the most interesting fruits of modern experimental research, is the knowledge of the fact, that electrical currents are in continual circulation below the surface of the earth. Whether these currents, so powerful in developing magnetical and chemical phenomena, are confined to mineral veins and particular arrangements of metal and rock, or generally capable of detection by refined apparatus well applied, appeared a question of sufficient importance to deserve at least a trial on the part of the Association. Our present volume records the result of such a trial on the ancient and very regularly stratified rocks of Cumberland, consisting of limestone, sandstone, shale, and coal, so superimposed in many repetitions as to resemble not a little the common arrangement of a voltaic pile. Varied experiments, with a galvanometer of considerable delicacy, failed to detect, in these seemingly favourable circumstances, any electrical current.

The extensive and rapidly-increasing applications of iron to public and private structures of all kinds in which durability of material is a first requisite, have made it highly desirable to possess accurate information respecting the nature of the chemical forces which effect the destruction of this hard and apparently intractable metal. The preservation of iron from oxidation and corrosion, is indeed an object of paramount importance in civil engineering. The Association was therefore anxious to direct inquiry to this subject, and gladly availed itself of the assistance of Mr. Mallet, a gentleman peculiarly qualified for such investigations, both from his knowledge as a chemist, and from his opportunities of observation as a practical engineer. An extensive series of experiments has accordingly been instituted by him, with the support of the Association, on the action of sea and river water, in different circumstances as to purity and temperature, upon a large number of specimens of both cast and wrought iron of different kinds. These experiments are still in progress, and the effects are observed from time to time. They will afford valuable data for the engineer, and form the principal object of the inquiry, but a period of a few years will be required for its completion. In the meantime, Mr. Mallet has furnished a report on the present state of our knowledge of the subject, drawn from various published sources, and from his own extensive observations. In this report he examines very fully the general conditions of the oxidation of iron, and how this operation is greatly promoted, although modified in its results, by sea-water; also in what manner the tendency to corrosion is affected by the composition, the grain, porosity, and other mechanical properties of the different commercial varieties of iron. The influence of minute quantities of other metals, in imparting durability to iron, is also considered. Mr. Mallet devotes much attention to the consequences of the galvanic association of different metals with iron, a subject of recent interest from the applications of zinc and other metals to protect iron, which are at present agitated. He concludes this, his first report, by recommending a series of inquiries, ten in number, which will supply the desiderata immediately required by the engineer and by the chemist.

We have next to notice a report by Prof. Powell, 'On the present state of our knowledge of Refractive Indices for the standard rays of the solar spectrum in different media.' The difficulty which the fact of the dispersion of light has offered to the universal application of the undulatory theory, has been in a great measure removed by the analysis of Cauchy and others, who have considered the distances of the undulatory particles as quantities comparable to the length of a wave. Velocities of propagation of the different rays of the spectrum, are made to depend upon the length of wave which constitutes a ray of a given colour, and upon certain constants proper to the medium. These constants being obtained from observations on refractive indices for certain definite rays (or dark lines) of the spectrum, the refrangibility of any other definite ray (whose wave-length has been ascertained by examining an interference-

* Stukeley.

spectrum), becomes known, and may be compared with observation as a test of theory; such experiments have been made by Frauenhofer, Rudberg, and Prof. Powell, who has given a tabular view of the various results, without, however, instituting the comparison between theory and observation, which it would be desirable to extend further than has yet been done. It would be important also to elucidate the disturbing effect of temperature, which prevents even existing observations from being rigorously comparable.

The calculations respecting the tides, which have been prosecuted by the aid of the Association ever since its institution, have been continued this year by Mr. Bunt, under the directions of Mr. Whewell. These calculations have now reached such a point, that the mathematician, instead of being, as at the beginning of this period, content with the first rude approximations, is now struggling to obtain the last degree of accuracy.

The country in which we are now assembled has always been conspicuous for attention to meteorology, a branch of physical science in which the British Association, with its power of combining the efforts of many observers in distant quarters of the globe, may hope to be especially useful.

In Scotland, Leslie opened a new train of inquiry, by examining the earth's temperature at different depths; and his successor in the University of Edinburgh is now directing, at the request of the Association, a large and complete course of experiments on that interesting subject. Framed in conformity with the plans adopted for similar objects by Arago and Quetelet, these reseaches of Professor Forbes contain also the means of determining the power of conducting heat, which different sorts of rock possess; and may thus throw light on some of those peculiarities in the distribution of temperature at greater depths below the surface, which have become known by experience, but are not explained by theory.

In Scotland, Sir David Brewster was the first to obtain an hourly meteorological journal for a series of years, and to draw from that fertile source new and important deductions, which have had a powerful influence on the progress of scientific meteorology. How gratifying to receive, through the same hands, after a lapse of nearly fifteen years, an additional contribution of the same kind, and from the same country; but embracing new conditions, on a new line of operations, in order to obtain new results. By the observations now in progress at Inverness, and at Kingussie, the influence of elevation in modifying the laws which have been found to govern the hourly distribution of heat near the level of the sea, may be discovered, and thus a great addition be made to the experimental results, for which science has long been grateful to the distinguished philosopher we have named, and which have been described as "of the highest value to meteorology, and as the only channel through which any specific practical information can be obtained in this most interesting department of physics."

This is no ordinary praise. It is the just tribute of one who is worthy to offer it; one, who at the call of the British Association, has conducted at Plymouth a still more extensive series of similar observations, and has added to them hourly comparisons of the temperature and moisture of the air, and an hourly record of barometric oscillations. Mr. Snow Harris has presented in a few pages of our last report, the precious results of (70,000) observations, and thus rendered them immediately available in the foundations of accurate meteorology. The documents thus patiently collected are, however, not yet exhausted in value; they may be again and again called into the court of science, and made to yield testimony to other, and as yet, unsuspected truths. They must not be lost. Shall we lay them by in manuscript among other unconsulted records of the past labours of men, or by undertaking their publication, do justice to our workmen, and establish a new claim on the imitation of the present, and the gratitude of future days? This question is of serious import. Already, stimulated by success in thermometric registration, we have set to work on a more perplexing problem; we have resolved to bind even the wandering winds in the magic of numbers. While we speak, the beautiful engines of our Whewells and Oslers, are tracing at every instant of time, the displacements of the atmosphere at Cambridge, at Plymouth, at Birmingham, in Edinburgh, in Canada, in St. Helena, and at the Cape of Good Hope; and, ere long, we may hope to view, associated in one diagram, the simultaneous movements of the air over Europe, America, Africa, India, and Australia, recorded with instruments which *we* have chosen, by men whom *we* have set to work.

Amongst the causes which tend to retard the progress of science, few, perhaps, operate more widely than the impediment to a free and rapid communication of thought and of experiments, occasioned by difference of language. It appeared to the British Association, that this impediment might, in some degree, be removed, as far as regards our own country, by procuring, and causing to be published, translations of foreign scientific memoirs judiciously selected. Accordingly, at each of the meetings at Newcastle and Birmingham, a grant of 100*l.* was placed at the disposal of a committee appointed to carry this purpose into effect. Aided by the contributions of several translations which have been gratuitously presented to them, the committee have been enabled, in the two last years, to publish fourteen memoirs on subjects of prominent interest and importance in the mathematical and physical sciences, bearing the names of some of the most eminent of the continental philosophers.

Such, gentlemen, is an imperfect review of our recent proceedings. In two essential respects the British Association differs from all the annual scientific meetings of the Continent, no one of which has printed Transactions or employed money in aiding special researches. We also differ from them in the communications which, in the name of the representatives of science, assembled from all parts of the United Kingdom, we feel ourselves authorized to make from time to time to the Government on subjects connected with the scientific character of the nation. On our first visit to Scotland, for example, we felt it to be an opprobrium that this enlightened kingdom should, in one essential feature of civilization, be still behind many of the continental states, and we prepared an address to his late Majesty's Government, urging strongly the necessity of the construction, without delay, of a map of Scotland, founded on the trigonometrical survey. Representations to the same effect have since been made by the Royal Society of Edinburgh, and by the Highland Society, and the subject has now engaged that attention which will, we trust, soon procure for this country the first sheets of a large and complete map.

If, then, it be asked why are the men of highest station happy to associate and mingle with us in official duties? Why have the heads of the noble houses of Fitzwilliam, Lansdowne,* Northampton, Burlington, Northumberland, and Breadalbane, alternated in presiding over us, with our Bucklands, our Sedgwicks, our Brisbanes, our Lloyds, and our Harcourts? Why, indeed, on this very occasion has Argyll himself, overlooking the claims due to his high position, and his ancient lineage, come forward to act with us, and even to serve in a subordinate office? May we not reply, that it is, we believe, a consequence of the just appreciation on the part of these patriotic and enlightened noblemen, of the beneficial influences which this Association exercises in so many ways on the sources of the nation's power and honour.

If we have hitherto dwelt almost exclusively on the value of our transactions, researches, recommendations, and the good application of our finances, let it not, however, be supposed, that we are not also fully alive to the advantages which flow from the social intercourse of these meetings, by bringing together, into friendly communion, from distant parts, those who are struggling on (often remote and unassisted) in advancing experimental science. If, indeed, this principle of union (which we are proud to have borrowed from our German brethren,) has been hitherto found to work so well amongst our own countrymen, we cannot but doubly recognize its value when we see assembled so many distinguished persons from foreign countries. In the presence of these eminent men, we forbear to allude to individual distinctions, conscious that any brief attempt of our own would fall far short of a true estimate of merits, the high order of which is indeed known to every cultivator of science in Britain. Well, however, may we rejoice in having drawn such spirits to our Isle; valuable, we trust, will be the comparisons we shall be enabled to make between the steps which the different sciences are making in their countries and in our own.

That advantages, indeed, of no mean order arise from such social intercourse, is a feeling now so prevalent, that foreign national associations for the promotion of natural knowledge, have rapidly increased. Germany, France, and Italy have their annual Assemblies, and our allies of the Northern States, hold their sittings beyond the Baltic. In all this there is doubtless much good, but an occasional more extensive intercourse of a similar nature, to be repeated at certain intervals, is greatly to be desired.

It has therefore appeared to us (and we say it after consultation with many of our continental friends, who equally feel the disadvantage), that the formation of a general congress of science might be promoted at this meeting, which, not interfering with any assemblies yet fixed upon, or even contemplated, may be so arranged as to permit the attendance of the officers and active members of each national scientific institution.

If the British Association should take the first step in proposing a measure of this kind, and should solicit the illustrious Humboldt to act as President, we are sure that scientific men of all nations would gladly unite in offering this homage to a man whose life and fortune have been spent in their cause, whose voice has been so instrumental in awakening Europe to the inquiry into the laws of terrestrial magnetism, and whose ardent search after nature's truths has triumphed over the Andes and the Altai.

If such be your suggestion, then will a fresh laurel be added to the wreath of this city. She who, through the power bequeathed to her by her illustrious offspring, conveys with rapid transit her inventions and her produce to the remotest lands, well can she estimate the value of an union of men whose labours can but tend to cement the bonds of general peace. In such a body the British representatives would, we trust, form no unconspicuous band; and with minds strengthened by the infusion of fresh knowledge, they would, on re-assembling for our own national ends, the better sustain the permanent and successful career of the British Association.

Mr. Taylor, the Treasurer, then read the Report of the Receipts and Expenditure for the past year, already published in our report of the proceedings of the General Committee.

Mr. Phillips announced the order of proceedings; and added, that a steamer had been placed at the disposal of the Association, which would convey the Members to Arran at six o'clock on Saturday morning; and that the railway-proprietors had offered to convey Members to and from Ardrossan.

OUR WEEKLY GOSSIP.

It is out of our power this year to give up a whole number to the report of the proceedings of the British Association. Unfortunately the meeting takes place a month later than usual, and Madame Vestris has been pleased to open Covent Garden theatre a month earlier than usual, and to bring forward, out of all season and reason, a new tragedy by Sheridan Knowles; our Birmingham friends, too, insist on a column for Mendelssohn and their Festival; and the advertisers are beginning to be importunate: indeed, the only considerate people are the booksellers, who have, we believe, closed their warehouses, and gone themselves to Glasgow or to sleep; so that the scientific public must be content this week with some fifty columns by way of introduction. Our Report will, of course, proceed regularly until completed, but we shall so far anticipate as to record the proceedings of the General Committee on Monday and Wednesday last.

The Committee assembled at three o'clock on Monday to determine on the place to be selected for the next meeting of the Association. Invitations were received from Manchester, York, Devonport, and Hull. The high claims of Manchester were fully

* The Marquis of Lansdowne, who had accepted the office, was prevented from attending by deep domestic affliction, and the Marquis of Northampton cheerfully supplied his place.

recognized, but it being understood that it would be more convenient to the gentlemen of that city that the visit should take place in the year 1842, the preference was therefore unanimously given to Plymouth and Devonport; with the general understanding that the Association would assemble in Manchester in the year 1842. It was resolved that the precise time of meeting should be fixed by the Council after consulting with the local authorities. The following noblemen and gentlemen were elected officers for the ensuing year:—*President*, Prof. Whewell.—*Vice Presidents*, Earl Morley, Lord Eliot, Sir C. Lemon, Sir T. D. Acland.—*Local Secretaries*, W. Snow Harris, Esq., Col. Hamilton Smith, Robert Weir Fox, Esq.—*Local Treasurer*, Mr. H. Woolcombe.—Messrs. Murchison, Sabine, Yates, Phillips, and J. Taylor, were re-elected to their several offices. On the motion of Sir JOHN ROBISON, seconded by Mr. LYELL, it was referred to the Council to take into consideration the propriety and the means of reducing the amount of the local expenditure in places visited by the Association. The Treasurer stated that, up to Saturday night, 1,290 tickets had been issued, and the sum of 2,490*l*. received.

On Wednesday the Committee again assembled at two o'clock to take into consideration the grants and applications which had been sanctioned by the Committee of Recommendations. They were as follows:

	£.	s.
From Section A.		
Hourly meteorological observations at Kingussie and Inverness	85	0
Observations on Tides of Leith	50	0
Ditto Bristol	50	0
A mountain barometer and thermometer for Quebec	20	0
Reducing meteorological observations, under the direction of Sir J. Herschel	100	0
Nomenclature of stars	50	0
Reduction of stars in Histoire Céleste	150	0
Catalogue of stars, to be called British Association Catalogue	150	0
Reduction of anemometrical observations	40	0
Erecting an anemometer at Inverness	60	0
Two actinometers	10	0
Action of gases on light	75	0
Reduction of La Caille's stars	184	5
Meteorological observations at Plymouth	35	0
Ditto of anemometer at ditto	20	0
Tabulation of experiments on subterranean temperature	20	0
Co-operative magnetic observations	50	0
Section B.		
Translation of scientific memoirs	100	0
Action of water on iron	50	0
Chemistry and physiology of digestion	200	0
Section C.		
Experiments on mud in rivers	20	0
To procure correct drawings of railway sections	200	0
To M. Agassiz, for researches into the old red sandstone, more particularly relating to fossil fishes	100	0
Ascertaining subterranean temperature in Ireland	100	0
Registering shocks of earthquake in Scotland and Ireland	20	0
Experiments on the solution of silica in water of high temperature	25	0
Section D.		
Experiments on preservation of animal and vegetable substances	6	0
Skeleton maps, exhibiting geographical distribution of plants and animals	25	0
Examination of the Anopleura Britannica	50	0
Dredging for marine zoology	50	0
Investigating the nature of plants and animals in mineral and artificial waters	6	0
Experiments on the vegetative power of seeds	10	0
Preparing questions to determine the varieties of the human species	15	0
Section E.		
Researches on acrid poisons	25	0
Comparison of acoustic instruments	25	0
Investigation of veins and absorbents	25	0
Section F.		
Educational statistics	100	0
Vital ditto	100	0
Coal ditto	25	0
Section G.		
To ascertain temperature of maximum condensation of steam	25	0
For Roberts's anemometer, to measure short intervals of time	30	0
For dynamomical apparatus to measure the work of a steam-engine	100	0
Experiments on form of vessels	100	0

Applications were directed to be made for the following reports:—

Prof. Airy on the recent progress of astronomy, and on the best means of printing the hourly meteorological observations.

Prof. Willis on sound.

Very Rev. Mr. Peacock on the differential and integral calculus.

Prof. Wheatstone on vision.

Sir W. Hamilton on the lunar theory.

Prof. Kelland on undulations.

Prof. Kelland on the mathematical theory of heat.

A Committee to ascertain the best means of investigating the upper strata of the atmosphere through the agency of air balloons, and also to report on the propriety and practicability of such experiments, and to draw up queries for aerial voyagers.

Prof. Johnston on inorganic chemistry and chemical geology.

M. de la Rive on electro-chemistry and electro-magnetism.

Dr. Daubeny on the connexion between agriculture and chemistry.

Prof. Bache, of Philadelphia, on the meteorology of America.

Sir John Dalyell on the habits of radiate animals.

Mr. Fairbairn on Williams's method of combustion.

Mr. Hodgkinson on the resistance of the atmosphere.

Mr. Smith on water-wheels.

It was also resolved that application should be made to her Majesty's Government to reduce the lunar observations made at Greenwich.

The Treasurer stated that 2,610*l*. had been received for tickets in Glasgow. The number of new members was 995, of old life members who attended 121, of old annual members 107, of foreigners 40; making, in all, 1,353 members at Glasgow.

Mr. Strickland gave notice that he would bring the following plan under the consideration of the General Committee at Plymouth; but he subsequently agreed that its consideration should be referred to the Council.

That the Sectional Meetings should be divided into two classes, viz. *Morning Meetings* from 10 to 1, and *Afternoon Meetings* from 1 to 4; and that they should be so arranged, as that the allied subjects discussed at the meetings should interfere with each other as little as possible. Thus, I would propose that Section A, of Mathematics and Physics, Section C, Geology, Section E, Medical Science, and Section F, Statistics, should all meet simultaneously at 10 A.M.; and that Section B, Chemistry and Mineralogy, D, Zoology and Botany, and G, Mechanical Science, should all meet at 1 P.M., immediately on the termination of the previous series of Sectional Meetings.

Mr. Murchison declared that the Council would take the matter into consideration, but added that he feared Mr. Strickland's plans would be found impracticable.

After the meeting of the General Committee, the General Meeting took place at the theatre, the President, the Earl of Breadalbane, in the chair, when the customary thanks were moved and agreed to; after which, the more distinguished visitors dined with the Lord Provost and magistrates.

The *Derby Reporter* of the 17th contains an exceedingly interesting account of the opening of an Arboretum in that town. It extends over nearly eleven acres, has been laid out by Mr. Loudon with great taste and judgment, both with reference to ornament and utility: and now, when completed, and worth, it is believed, at least 16,000*l*., has been presented by Mr. James Strutt to Trustees for the benefit of the public. The noble purpose of this excellent and munificent man cannot be better expressed than in his own words:—"There has of late," he observed, "been a rapid increase in the trade and population of the town of Derby. Manufactures have been extending, new buildings have been erected on all sides, and a still further addition to the commercial importance of the town may be expected, in consequence of the completion of three new railways, which, by the junction at this place, offer great facilities for our intercourse with other parts of the kingdom, and render Derby an important centre of communication. Whilst these works have been in progress, the improvement of the town has not been neglected; and I should only have to refer to the recent improvements in our streets and public buildings—to the establishment of our efficient Police—and to the almost unexampled success which has attended our Mechanics' Institution, if I wished to give instances of the adoption of measures for promoting the convenience, the good order, and the instruction of our population. But whilst means have been so creditably taken for these important objects, no provision has been made for supplying a scarcely less urgent want of the inhabitants of a large and increasing town—the opportunity of enjoying with their families, exercise and recreation in the fresh air, in public walks and grounds devoted to that purpose. I have therefore determined to appropriate a piece of land for the purpose of public walks for the recreation of the inhabitants. Being desirous of uniting, as much as possible, information with amusement, I have been anxious not only that these walks should be laid out in the most advantageous manner, but that they should comprise a valuable collection of trees and shrubs, so arranged and described, as to offer the means of instruction to visitors. These objects have been most ably and successfully accomplished by that distinguished landscape gardener, Mr. Loudon, who entered largely and liberally into my views, and furnished the plan, which has since been executed under his superintendence." The first condition of the trust is thus declared to be:—"That the Arboretum shall be open to all classes of the public without payment, and subject only to such restrictions and regulations as may be found necessary for the observance of order and decorum, on every Sunday, and also on at least one other day in every week, from sunrise to sunset,"—the Committee being at liberty to fix such terms of admission on the days not appropriated to the public as they may consider sufficient to keep the Arboretum in perfect order. "It has often," Mr. Strutt observed, "been made a reproach to our country, that in England collections of works of art and exhibitions for instruction or amusement, cannot, without danger of injury, be thrown open to the public. If any ground for such a reproach still remains, I am convinced that it can be removed only by greater liberality in admitting the people to such establishments—by thus teaching them that they are themselves the parties most deeply interested in their preservation—and that it must be the interest of the public to protect that which is intended for the public advantage. If we wish to obtain the affection and regard of others, we must manifest kindness and regard towards them; if we seek to wean them from debasing pursuits and brutalizing pleasures, we can only hope to do so by opening to them new sources of rational enjoyment. It is under this conviction that I dedicate these gardens to the public; and I will only add, that, as the sun has shone brightly on me through life, it would be ungrateful in me not to employ a portion of the fortune which I possess, in promoting the welfare of those amongst whom I live, and by whose industry I have been aided in its acquisition."

The American papers announce the death of Mr. Timothy Flint, at Reading, Massachusetts. Mr. Flint, we believe, was born in New England. We, however, first heard of him as editor of a monthly review, and a resident at Cincinnati, when he had the singular good fortune to win a word of commendation from Mrs. Trollope. Subsequently he became a settler on the Red River, in Arkansas. He was a man of undoubted ability, and, as we know, personally, of high honour and integrity; a voluminous writer, many of whose works were republished in this country; but best known here as the author of 'Recollections of the Mississippi Valley.' He contributed to the *Athenæum*, in 1835, some very pleasant papers on American Literature.

We learn from Paris that a Faculty of Sciences has been established in the Academy of Rennes. It consists of five chairs,—Mathematics, Natural Philosophy, Chemistry, Zoology and Botany, and Geology and Mineralogy. M. Dujardin, well known by many valuable papers presented to the Academy of Sciences, has been placed at the head of it.—The Grand-Duke of Baden has also established a Professorship of French Civil Law in the University of Heidelberg, and given the appointment to Doctor Louis Frey, of Strasburg;—and, as a curious psychological experiment, we may mention the appointment of a Singing Professor in the school established by Dr. Leuret for the insane (*aliénés*) at Bicêtre—extraordinary results having, it is said, been obtained from the application of vocal music in the treatment of patients of that melancholy class.

We adverted last week to the spread of French and German music in Italy. In addition to the rumours then given, there are tidings from Florence that the interdict upon 'Robert the Devil' is about to be taken off, Mdlle. Mequillet, a French actress,

being at present engaged in the study of the part of Isabelle, in the expectation of its being produced in December next. At Perpignan a new actor, of fearful power, introduced himself on to the stage during a rehearsal, and played his part in a terrible tragedy. The theatre was struck with lightning, and the electric fluid passed across the stage striking to the ground the assembled actors, male and female, and killing on the spot one of the choristers.

DIORAMA, REGENT'S PARK.

NEW EXHIBITION, representing THE SHRINE OF THE NATIVITY at Bethlehem, painted by M. Rénoux, from a Sketch made on the spot by David Roberts, Esq. A.R.A., in 1839. "The spectator may almost suppose himself in the very birth-place of the Saviour."—*Times*. Also, THE CORONATION of Queen Victoria in Westminster Abbey, by M. Bouton. Open from Ten till Five.

In consequence of intended changes, the present time, and the approaching Michaelmas holidays, afford the only opportunity for visiters to see all the recent SCIENTIFIC NOVELTIES, which are increasing daily. The Works exceed in number 1,200. The engines and various models are at work; among them Hall's Patent Water Elevator, and the Rotation Railway Models; Green's Balloon and Guide Apparatus; the Microscope and Chromatic Fire Cloud. The Chordæolian, with two fine performers, at 4 o'clock; the Glass Weaving; the 120 fine Daguerréotypes, and many other Works. Experiments and Lectures. The Exhibition will be closed on the 2nd of October until the middle of November, for changes, decoration, and addition.—A new edition of the Catalogue, with fine Illustrations. Admission, 1s.—POLYTECHNIC INSTITUTION, 309, REGENT-STREET.

MUSIC AND THE DRAMA

MUSIC IN THE PROVINCES.

THE BIRMINGHAM FESTIVAL.—The first two days' performances of the Birmingham Festival contained, in themselves, matter sufficient to fill the musical portions of many *Athenæums*, with illustrations of the state of English taste and the manner of English execution. An excellent *locale*—few public rooms being so admirably fitted for the purpose of hearing or seeing as the Town Hall—excellent materials, in the shape of a chorus vigorous and ready, thirteen principal singers, and an orchestra powerful enough, when not absolutely borne down by the pedal thunder of the stupendous organ—an audience, too, by no means cold or unintelligent in its admiration,—what more could be wanting, to satisfy the most exacting critic? Two things,—and neither of these unimportant: a wise judgment in the combination of such materials, and a musical conductorship sufficiently experienced and energetic to insure their executive perfection. Both were needed. In the programme of the first morning's performances (yet more in that of the second), not only was the scrap system of selection disagreeably manifest, but the work put forth as a principal feature of the first day—Handel's admirable 'Israel'—was seriously damaged by omissions and interpolations. 'Holy, holy,' at best a transplanted opera song, was thrust in, to interrupt that splendid passage of choral narration, where the "darkness which might be felt," and the sword of the avenging Angel "smiting the first-born of Egypt," are successively described, in awfully contrasted strains—while 'Thou shalt bring them in,' the sweetest song in the oratorio, was left out—these being only two, among many instances which might be given. Again, at the evening's concert, it was vexatious to see the chorus sitting idle, when its judicious use would have so gratefully relieved the long string of songs, duetts, &c. Nor was the conductor adequate to the call made upon him: it is no disparagement to Mr. Knyvett's reputation as a refined chamber musician to say, that he is unequal to the task of swaying, whether by restraint or encouragement, a mass so large and heterogeneously made up as the orchestra of one of our provincial festivals: too obvious proof of which was given in the coarse or wavering execution of many of Handel's choruses, known to all his subjects by heart, as compared with the delicacy and promptitude of the same body, when applying themselves to render a new composition—the 'Lobgesang,'—under the guidance of a foreigner, its composer.

To this work, as the principal novelty of the Festival, we come without further delay. Such a hymn of Praise as the 'Lobgesang,' which was written for the Gutemberg Festival at Leipsic, ought to be an outpouring of thanksgiving, which, acknowledging a blessing vouchsafed, is cheerful but not proud, thus distinct from Triumph glorying over an achieved conquest. And this, if impression answer intention, and we have at all comprehended his purpose, Dr. Mendelssohn has fully accomplished. There is Joy with understanding every where evident in the brighter portions of his work, while even in the glances thrown upon distress and deep affliction gone by—such acknowledgment being indispensable to Gratitude's full exercise—the presence of Hope and Comfort is manifest: the sorrow is not felt to be cureless, the shadow of Death not displayed as a pall of final sepulture, but as a veil which the Highest has decreed *shall* pass. This general idea has been wrought out by the musician with the happiest skill. From the first bold and exulting phrase of the symphonic portion of the work, to the last chords of the final fugue, where all the intertwined vocal and instrumental parts return to the same grand and simple unison, the prevailing spirit is illustrated with a delightful variety of resource,—witness in the second instrumental movement the major chords of the wind instruments introduced to relieve the minor strain,—witness that exquisite duet, with its supporting chorus, 'I waited for the Lord,'—the subsequent chorus in D major, 'The night is departing,'—and the *corale* at first harmonized in four parts, and then given in unison, by the entire mass of voices, the orchestra maintaining, on its repetition, a rich but not distracting accompaniment. More closely to analyze this Hymn would require more space than we can command, even were it possible to do so on the strength of a single hearing: we must return, however, for one moment, to specify the duet for the two *soprani* already mentioned, as one of the most legitimately engaging movements which modern art has produced; nor can the whole work be left without our once again repeating, that, whether as regards poetry of conception or skill of execution, it is worthy of the composer of the conversion scene in 'St. Paul.'

We must not forget Dr. Mendelssohn's organ performances, as another feature of the Festival. Critics with nicer balances than ourselves shall declare whether or not they are better of their kind than his treatment of the pianoforte—both being, to our judgment, of the highest order,—devoid of the slightest admixture of concession to the taste of the hour, and yet how forcible and how animating! But we must have done with this hasty sketch, when we have said a word or two concerning the vocal part of the Festival. As far as we followed this, Miss Hawes and Mr. Braham bore the palm away from among our English singers: the former by her distinctness of articulation and dignity of style—which, however, she must take care lest she exaggerate into a mannerism,—the latter for showing us a marvel on Tuesday morning, by making us forget the voice that *was* in the passionate and expressive declamation that yet *is*. In the 'Lobgesang' Nature more decidedly asserted herself, and the artist was, of course, far less happy. Madame Caradori, though sufficiently admired in 'Angels ever bright and fair' to be *encored* from the President's gallery, was not singing in tune, and in her delicate passages was scarcely audible. Madame Dorus-Gras, in her attempts to pronounce English with her usual clearness and emphasis, seemed to us more French than we have hitherto heard her; though compelled, by the size of the Hall, to force her voice, she was still most successful. Lablache was, as he always is, admirable.

A last word must be given to the acknowledgment of the satisfactory arrangements for the accommodation of the audience made by the Committee.

COVENT GARDEN.—Mr. Sheridan Knowles has added another to the series of "plays of the affections" with which he has enriched our modern dramatic literature; for, whatever may be the nominal subject, Love, between parent and child, or man and woman, is still his theme; and it is one of which he never tires, nor his readers either. 'The Bride of Messina,' or, as the printed copy has it, 'John of Procida, or the Bridals of Messina,' though professing to develope the character of the great leader of the revolt of Sicily against its French conquerors, rendered memorable by the 'Sicilian Vespers,' is a tragedy of true love, ending in the deaths of the faithful pair, which follow their union, though, for aught that appears to the contrary, they might have "lived happy ever after," had the author so pleased. *Isoline*, the Bride of Messina, is the daughter of the French governor of Sicily, and her bridegroom, *Fernando*, is the son of his enemy, *John of Procida*, who had been not only proscribed, but his castle sacked, and his wife ravished, by the governor. The lovers, of course, are not aware of this horrible bar to their union; and *Procida* is even ignorant of his son's existence, supposing the boy to have perished when an infant. The play commences with the arrival of *Procida* in disguise at Messina, to rouse the Sicilians to vengeance. The effect of his eloquence is thus vividly depicted in the opening dialogue:—

Guiscardo. His words were fire—both light and heat! At once
With zeal they warm'd us, and convinced with reason.
I had read and heard of eloquence before,
How 'tis despotic; takes the heart by storm,
Whate'er the ramparts, prejudice, or use
Environ it withal; how, 'fore its march,
Stony resolves have given way like flax;
How it can raise, or lay, the mighty surge
Of popular commotion, as the wind,
The wave that frets the sea;—but, till to-day,
I never proved its power. When he began,
A thousand hearers prick'd their ears to list,
With each a different heart; when he left off,
Each man could tell his neighbour's, by his own.
Stephano. Is't John of Procida?
Guis. So rumour says.
Who else? The constant'st friend of Sicily;
The friend that loves, yet suffers for his love.
Heard'st ever lips before, with power like his?
A holy man, and brigand, near me stood,
Wedged by the press together; churlishly
They first endured their compell'd neighbourhood,
And shrank from contact, they would fain escape;
The one with terror; and with scorn the other,
Who blaz'd with life and passion, like a torch
Beside a taper;—such the man of prayer
Appear'd, in contrast with the freebooter.
But, lo! the change! soon as the orator
That universal chord, with master skill,
Essayed—the love of country—like two springs,
Ravines apart, whose waters blend at last
In some sweet valley; leaning cheek to cheek,
Attracted by resistless sympathy,
Their tears together ran, one goodly river!

Procida learns that his son is alive from a monk, who accidentally identified him by a scar, and he stops the bridal procession, which had before been interrupted by a ghastly incident, and forbids the rites. *Fernando* follows the mysterious intruder to a retired spot, where the stranger narrates to him the story of the fall of Manfred, King of Sicily, and the judicial murder of his successor, Conradine, whose gauntlet, thrown from the scaffold by the princely victim, he had picked up. This gage he now produces, and calls upon *Fernando* to take an oath of fealty to the cause of Sicily:—

Procida (taking a glove from his breast). There 'tis. There! —as I pluck'd it from the scaffold foot!
The look that martyr cast upon me then,
It shed more healing unction on my soul,
Than fifty thousand masses at my death
Could do, each chanted by as many lips,
And all of holy men. Now mark how Right,
Although, at setting out, a dwarf in thews,
By holding on will gather sinew, till
It moves that giant Might. With seconding,
Levies, munitions, allies, subsidies—
None other than this empty glove, I went
From Sicily; where now I stand again,
With monarchs and their kingdoms at my back,
The sworn abettors of the righteous hand
Which, fleshless, tendonless, reduced to bone,
Its holy cause with life thus clothes again,
And arms with retribution. That same hand
Once fill'd this glove, which now I hold to thee.
Take it.
Fernando. For what?
Pro. To swear by it.
Fer. The oath?
Pro. Death to the Gaul, whoe'er he be, that now
Has footing in the land!—Death without pause
Of ruth—eye, ear, be stone to voice or look
Of deprecation! Once your blade is out,
While there's a tyrant's heart to lend a sheath,
Never to let it know its own!
Fer. That oath
I will not take.
Pro. Thou wilt not? Thou'rt a traitor!
Fer. Ha!
Pro. Thou art a coward!
Fer. (*drawing*). Try if I fear death!
Pro. Death is a little thing to brave or fear.
Except a thought of the after reckoning,
The which to fear becomes, not shames a man:
Tis but a plunge and over, ta'en as oft
By the feeble as the stout. Give me the man
That's bold in the right—too bold to do the wrong.

Finding the youth resolute, he taunts him with his Sicilian birth, and reiterates the question, "Hast thou a father?" till indignation melts into sorrow.

Pro. Hast thou a father, still
I say to thee?
Fer. Thy sword, or I'm upon thee!

Pro. Then wilt thou have a murder on thy soul,
For from my stand I will not budge an inch,
Nor move, so far, my arm to touch my sword,
Until thou answer'st me. Hast thou a father?
Fer. (*bursting into tears*). No,—no! thou churlish, harsh, remorseless man—
That bat'st me with thy coarse and biting words,
As boors abroad let loose unmuzzled dogs
Upon a tether'd beast! my arm withheld
By thy defencelessness, that hast defence
At hand, but will not use it—who art thou
To use me thus? to do me shameful wrong
And then deny me means to right myself?
What have I done to thee to use my heart
As if its strings were thine to strain or rend!
Thou mak'st my veins hot with my boiling blood,
And not content, thou followest it up,
Mine eyes inflaming with my scalding tears,
Thou kindless, ruthless man! Hast thou a father?
I never knew one!
Pro. (*aside*). I thank God!
Fer. Thou hadst
A father—hadst a father's training—O
How blest the son that hath. O Providence,
What is there like a father to a son?
A father, quick in love, wakeful in care,
Tenacious of his trust, proof in experience,
Severe in honour, perfect in example,
Stamp'd with authority! Hadst such a father?
I knew no training, save what fostering
Did give, in the mood; and was bestow'd
Like bounty to a poor dependent; which
He might take or leave. Those who protected me
Were masters of my native land, not sons.
How could I learn the patriot's lofty lesson?
They told me Sicily had given me birth,
But then they taught me also I was son
To a contentless and ungracious mother.
And they were kind to me. What wouldst thou have
Of a young heart, but what you'd ask of wax—
To take the first impression given to it?
Except that, unlike wax, it is not quick
What once it takes to render up again.
Pro. (*aside*). O, my poor boy!
Fer. If thou hadst a father,
'Twas cruel, knowing that thou wast so rich,
To taunt me, where, knew'st not that I was poor,
Thou mightst at least suspect my poverty.
How had I loved my father! He had had
The whole of my heart. I would have given it him
As a book to write in it whate'er he would.
I never had gainsaid him—never run
Counter to him. I had copied him, as one
A statue doth of the rare olden virtue,
In jealous, humble, imitation.
I had lived to pleasure him. Before I had
Disgraced him, I had died.

Procida now declares himself, and *Fernando*, in the first impulse of filial affection, offers to take the oath; but his father inconsistently gives him time for reflection, and allows him to return to Messina, to break off formally his meditated nuptials. *Fernando* encounters *Isoline*, and the following beautiful scene takes place between them:—

Isoline. Dost not joy, Fernando,
To see me?
Fernando. Joy!—Ay, as the mariner
To see the day o'erta'en by storm at night,
But knows 'tis vain, his vessel foundering!
Iso. Explain thy speech, my love.
Fer. He was a friend
Who took me hence; a most dear friend, although
One that I wot not of until to-day,—
None other than a father, Isoline!
Iso. Thou hast found a father?
Fer. I have found a father;
And with that father I have held such converse
As hath transform'd me so, except my love
I should not know myself; and being thus
Dissimilar to him this morning was
Thy bridegroom, from this night that should have been
Our bridal-night, all days and nights to come
Am nothing to thee thou mayst name, except
A merchant sailor for his argosie,
That holds possession of the rock whereon
She struck and went to pieces!
Iso. We must part!
Lovest thou me still, Fernando?
Fer. Yes!
Iso. As ever?
Fer. As ever!
Iso. Then, we do not part, my friend!
Fer. Is't Isoline that speaks?
Iso. Yes! Isoline!
The very maid thou know'st so call'd—a maid,
So chary of her virgin sanctity,
Thee, her betroth'd—thee, her almost espoused,
She challenges to tell the moment only
She gave thee licence, she would bar thee name,
Or blush to hear thee do so. Lo, the strait
She is in!—at such an hour—in such a place
To parley with thee, and the argument
Her grievance—thy default—default in love!
In love, Fernando! thy default in that
Wherein that she fell short was the reproach
Thou still didst urge against her, to the day
The very hour she gave thee slow consent
To lead her to the priest.
Fer. Heaven witness!
Iso. Peace!
No words—save such as make reply to questions.
We part—why? Lies the reason at my door?
Am I to blame? Then fit we part. If not,
It is not fit! I have no right to suffer.
Suffer, Fernando!—Did you hear me?—Heavens!
The boon, with showers of tears and gusts of sighs
You won from me, I call it suffering,
To find you would not take! But I'm a woman,
Strong in the faculty your nobler sex
Advance large claims to, with most poor pretensions—
Once cleaving, cleaving still. We shall not part.
You think to leave me. Try! The cement, that
Becomes a portion of the thing it joins,
So that as soon you tear themselves apart
As them from it, not more tenaciously
Keeps hold than I! Piecemeal, they may disjoin us,
But perfect, never!

* * * *

Fer. Now let me speak! To wed thee
Is wedding thee to misery!
Iso. Content;
I will wed misery.
Fer. My Isoline,
Thou wouldst ally thee to a house, the foe
Of thee and all thy race!
Iso. Unto that house
Will I ally myself.
Fer. The consequences!
Iso. Be they the worst, I am prepared for them.
I'll take them all on mine own head.
Fer. The strife that's sure to come!—Man as I am, my soul
Sickens to think on't.
Iso. Woman as I am,
I dare it to come on.
Fer. Rivers of blood
Will flow!
Iso. They are welcome, though my veins be breathed
To help the flood.—Redeem your promise, sir!
Fer. O, Isoline! By this dear hand—
Iso. Hold off!
In the relation wherein now we stand,
I will not suffer even touch from thee!
Nor shalt thou trifle with me—for to speak
Or act, save to the point, is only trifling.
Here—in the oratory close at hand
Attends the holy man, whose offices
This morning we did crave and then forego.
Follow me to him. Take my hand before him;
Plight me with troth for troth. Or here remain
Till night gives up her watch to day, and then,
Departing hence, to crown thy bounty, leave me
A spotless maiden with a blasted name!
Fer. Thou couldst not dream of such perdition, and
To bring it on thyself!
Iso. Men cannot dream
What desperate things a desperate woman dreams,
Until they see her act them!
Fer. Desperate!
Iso. Yes, desperate! Sweet patience! Men go mad
To lose their hoards of pelf, when hoards as rich
With industry may come in time again!
Yet they go mad—it happens every day.
Have not some slain themselves? Yet if a maid—
Who finds that she has nothing garner'd up
Where she believed she had a heart in store
For one she gave away—is desperate,
You marvel at her! Marvel! When the mines
Of all the earth are poor as beggary
To make her rich again! Am I ashamed
To tell thee this?—No!—Save the love we pay
To Heaven, none purer, holier, than that
A virtuous woman feels for him she'd cleave
Through life to. Sisters part from sisters—brothers
From brothers—children from their parents—but
Such woman from the husband of her choice
Never!—Give me the troth you promised me.

This is the climax of the interest, and the finest passage in the drama. *Fernando* yields, and they are, at once, secretly married. His conscience, however, smites him, and the dread of his father's reproaches embitters his brief moments of happiness. His father now summons him from the nuptial festivities, as before he did from the bridal procession, and another scene of upbraiding ensues, too much like the first, in which *Procida* tells his son the story of his private wrongs. Well may *Fernando* ask, "Why was this tale reserved, not told before?" Nor is the answer a sufficient excuse for the dramatist's breaking into separate scenes what ought to have been included in one, and delaying the disclosure, for the purpose of prolonging the suffering. *Fernando* naturally refuses to give up his bride, and *Procida* is leaving his son to share the fate impending over the French, when *Isoline*, having been told who the father of her husband was, enters, to inform *Procida* that he is discovered, and affords him a safe passage out of the city. Touched by this act of kindness, the father blesses the union he had just before denounced as rendering his son "worse than a matricide." The catastrophe "drags its slow length along" through the slough of accumulated horrors, that disgust without exciting. The bride refuses safety that is not shared by her father, and leaves her husband to seek the parent, whom, when she meets, is too terror-struck to recognize her: she swoons, *Fernando* believes her dead; and, defending himself over her body against the unprovoked assault of a former friend, is slain: and *Isoline* comes to her senses, like Juliet, only to see her husband dead, and dies distracted on his corse; the governor flies no one knows where, and *Procida*, baulked of his revenge, and robbed of his new-found son,—to the slayer of whom, who urges that *Fernando* "sided with the enemies of Sicily," his father says, "You did right—his father says it,"—has to console himself with the satisfaction of being the liberator of Sicily.

The glaring defects in the conduct of the plot, and the delineation of the principal character, will have been sufficiently evident from this sketch; and the quotations exemplify the force and eloquence of the dialogue, which, however, bears marks of haste in diffuseness of speech, repetition of ideas, and careless and inelegant phraseology. The resources of the practised dramatist are not shown in the management of the fable, for, contrary to obvious expediency, the interest is greatest in the first act, and is drawn upon in each successive act, until the thread is attenuated to invisibility; but only in the little arts by which the progress of the action is impeded, scenes are spun out, and the expression of natural sentiments is exaggerated into hyperbole: in a word, the author has tried to make too much of his subject. The result is, that the 'Bride of Messina' is likely to be one of the most short-lived of Knowles's plays. Its existence will assuredly not be prolonged by the force of the acting, which is rather below than above mediocrity. Mr. Moore is physically and intellectually inadequate to fill out the author's imperfect sketch with the attributes proper to such a character as *John of Procida*; indeed, he seems deficient in the ordinary resources of actors. Anderson, as *Fernando*, shone forth conspicuous by the contrast; and played with so much feeling and energy, as almost to excuse his violence. Miss Ellen Tree looks the Bride beautifully, and gave the familiar touches with a genuine sweetness and fervour that was delightful: she, however, assumes too commanding a tone and attitude when she reclaims her wavering lover, forgetting that it is the desperation of a woman on the eve of losing the promise of a life of happiness, which emboldens the gentle maid to insist upon her rights, against a father's claim to obedience. The costumes are rich and appropriate, and the scenery is so beautiful that it beguiles the tedium of the acting: in particular we should notice the ruins of an amphitheatre, with fragments of architecture strewn around; and a moonlight view of Etna, looking over the Bay of Messina. The last two acts of the play have been curtailed since the first night, but the catastrophe is still unimpressive.

To Correspondents.—A Correspondent, evidently a very sensible and amiable person, has drawn our attention to a paragraph, in the notice of Mr. Wightwick's 'Palace of Architecture,' which has a tendency, he thinks, to injure that gentleman as a professional man. "You say," he observes, "that *he* is not the architect you would choose to employ,"—and the writer proceeds to comment on the influence of such an opinion. Now, to prevent the possibility of misapprehension, or the remotest chance of doing a disservice to a gentleman every way entitled to respect, not only for what he has done but for *what he has attempted*;—a gentleman whom we know to be a man of ability, superior in acquirement to the majority of his professional brethren,—we declare at once that nothing could be further from our intention than the meaning here put on the paragraph referred to. Thus much premised, we must observe that our correspondent has not quoted the passage correctly. The work under review professes to be, as stated, an epitome of the architectural world—representing the great families of design in India, China, Egypt, Greece, Italy, Turkey, Moorish Spain, and Christian Europe,—by "A Prince Architect," who had laboured for fifty years, with unbounded resources at his command, at the fifty temples therein represented, resolved to eclipse the glory of Solomon and the Imperial Adrian. This is the fanciful language of the work, and what we stated was, that "*the Prince Architect*" was not the architect we should choose to employ,—meaning, and meaning simply, that *the gigantic work projected* was beyond the powers of Mr. Wightwick, and, we might perhaps have added, of any other living man. But *magnis tamen excidit ausis*: and it is not because Mr. Wightwick has failed to realize an idea beyond the conception of mere rule-and-line drudges, that it is therefore to be assumed that he is not their superior.

The Reports of the preceding Meetings of the British Association may still be had. Those for Dublin are contained in the Monthly Parts for August and September, 1835; Bristol, in August and September, 1836; Liverpool, September and October, 1837; Newcastle, August and September, 1838; Birmingham, August and September, 1839.

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